EXHIBIT 3

1991 RECORD OF DECISION

5 5 0010

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

MEDLEY FARM SUPERFUND SITE

GAFFNEY, CHEROKEE COUNTY
SOUTH CAROLINA

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION
REGION IV
ATLANTA, GEORGIA

5 9 0011

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Medley Farm
Gaffney, Cherokee County, South Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Medley Farm Superfund site in Gaffney, South Carolina chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record file for this Site.

The State of South Carolina concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment. The principle threat at this Site results from the unacceptable elevated levels of volatile organics in the groundwater.

DESCRIPTION OF THE SELECTED REMEDY

This remedy addresses the principle threat posed by this Site. The principle threat is the contaminated groundwater emanating from beneath the Site. This remedial action will also address residual soil contamination which, if left in place, would continue to adversely impact the quality of the groundwater for 20 years.

The major components of the selected remedy include:

GROUNDWATER

- Extraction of groundwater across the entire Site that is contaminated above Maximum Contaminant Levels or non-zero Maximum Contaminant Level Goals which ever are more protective;

5 9 0012

- On-site treatment of extracted groundwater via air stripping to remove the volatile contaminants from the water column with the need of controlling off-gas from the air-stripper to be evaluated in the Remedial Design;

- Off-site discharge of treated groundwater to Jones Creek via a National Pollution Discharge Elimination System Permit; and

- Continued analytical monitoring for contaminants in groundwater and surface water.

SOIL

- Installation of a network of air withdrawal (vacuum) wells in the unsaturated zone;

- Construction of a pump and manifold system of PVC pipes used for applying a vacuum on the air extraction wells to remove the volatile organic compounds and some semi-volatile organic compounds from the soil; and

- Implementation of an in-line water vapor removal system and an in-line vapor phase carbon adsorption system to remove organic compounds prior to releasing the extracted air to the environment.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utili[illegible]s permanent solutions and alternative treatment technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Since this remedy may result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Patrick M Tobin

Greer C. Tidwell
Regional Administrator

MAY 2 9 1991

Date

THE DECISION SUMMARY
FOR THE
RECORD OF DECISION

MEDLEY FARM SUPERFUND SITE

GAFFNEY, CHEROKEE COUNTY
SOUTH CAROLINA

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION
REGION IV
ATLANTA, GEORGIA

5 9 0074

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RECORD OF DECISION
SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
FOR THE MEDLEY FARM SUPERFUND SITE
GAFFNEY, CHEROKEE COUNTY, SOUTH CAROLINA

5 9 0019

1.0 INTRODUCTION

The Medley Farm site was proposed for inclusion on the National Priority List (NPL) in June 1986 and was finalized on the NPL in March 1990. As of August 1990, the Site ranks 918 out of 1218 NPL sites with a Hazardous Ranking System (HRS) score of 31.58.

The Remedial Investigation (RI) occurred in two phases. Phase I began in January 1988 with the signing of the Administrative Order on Consent (AO) and ended with the submission of a draft RI report in March 1990. Due to data deficiencies identified in this report, the Potentially Responsible Parties (PRPs) initiated Phase II of the RI. The revised draft RI report was submitted to the Agency in November 1990 and the draft Feasibility Study (FS) was delivered in December 1990. The Agency approved both the RI and the FS in May 1991.

This Record of Decision (ROD) has been prepared to summarize the remedial selection process and to present the selected remedial alternative.

2.0 SITE LOCATION AND DESCRIPTION

The Medley Farm site consists of an approximately seven-acre section of the Ralph Medley Farm parcel that is situated on top of a hill. The Medley Farm property consists of 61.9 acres of rural land located approximately six miles south of Gaffney, South Carolina in Cherokee County on County Road 72 (Burnt Gin Road). Figure 1 provides the general location of the Medley Farm property and Figure 2 shows the approximate boundaries of the Medley Farm property and the Site.

The approximate center of the Site is located at latitude 34°58'54" north and longitude 81°40'02" west. The surrounding land is hilly and consists mainly of woods and pasture land. The land use in the vicinity of the Site is primarily agricultural (farms and cattle) and light residential. No change is expected in the use of the Medley Farm property in the near future. It is anticipated that Mr. Ralph Medley will maintain ownership of this property.

Ground surface elevations at the Medley Farm property range in elevation from El. 558 feet, National Geodetic Vertical Datum (NGVD), at Jones Creek, to El. 689 feet NGVD at the highest point on the property. Topography of the Site is relatively flat with slopes ranging from three to ten percent. The land surrounding the Site slopes off steeply to the east and south with slopes ranging from 10 to 52 percent. The Site is covered with weeds, briars, and small scrub trees, but the remainder of the Medley property is mostly a dense forest of hard- and softwoods. Based on observations of Site topography, surface drainage occurs to the northeast and east, to the southeast, and to

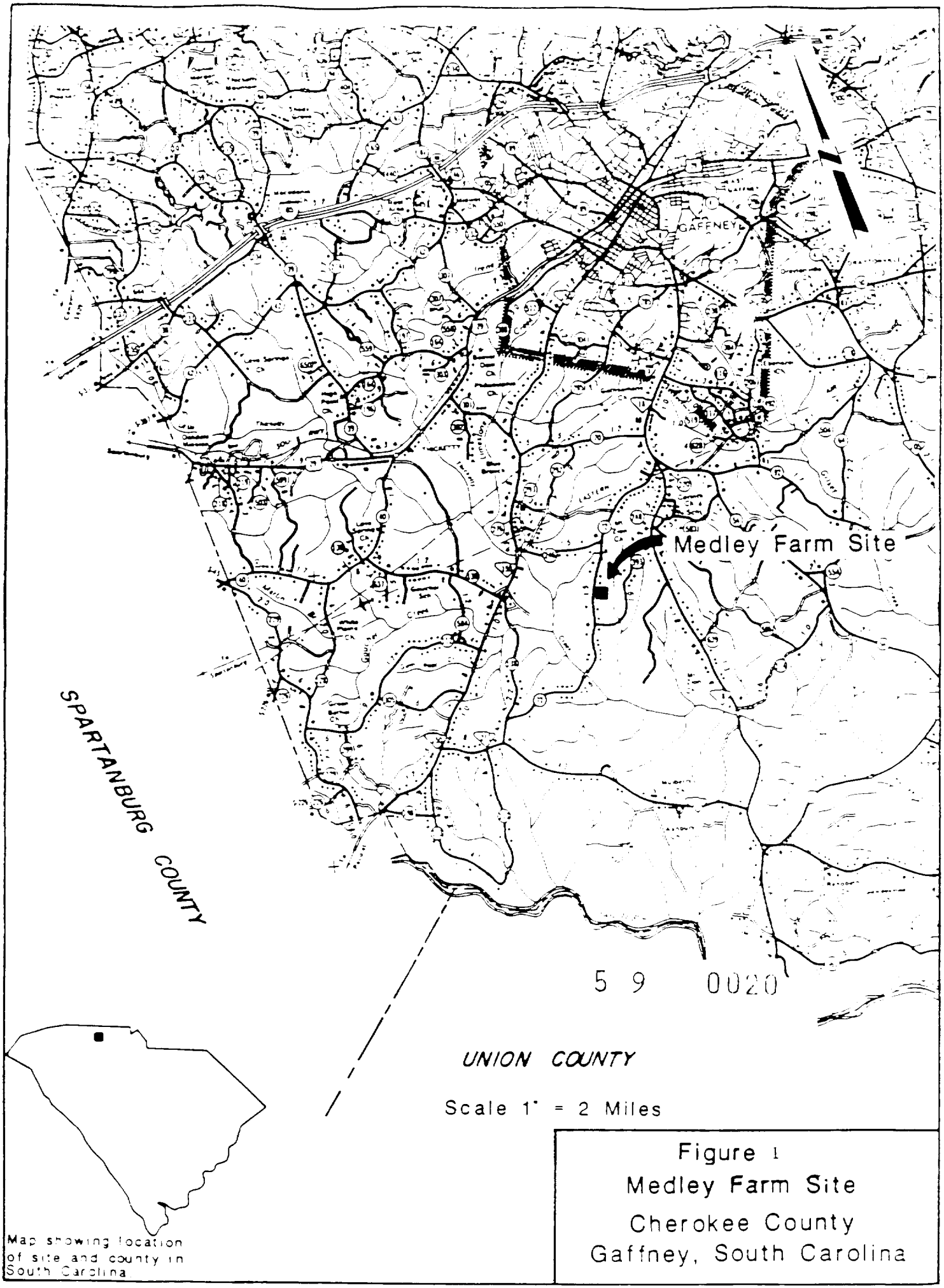
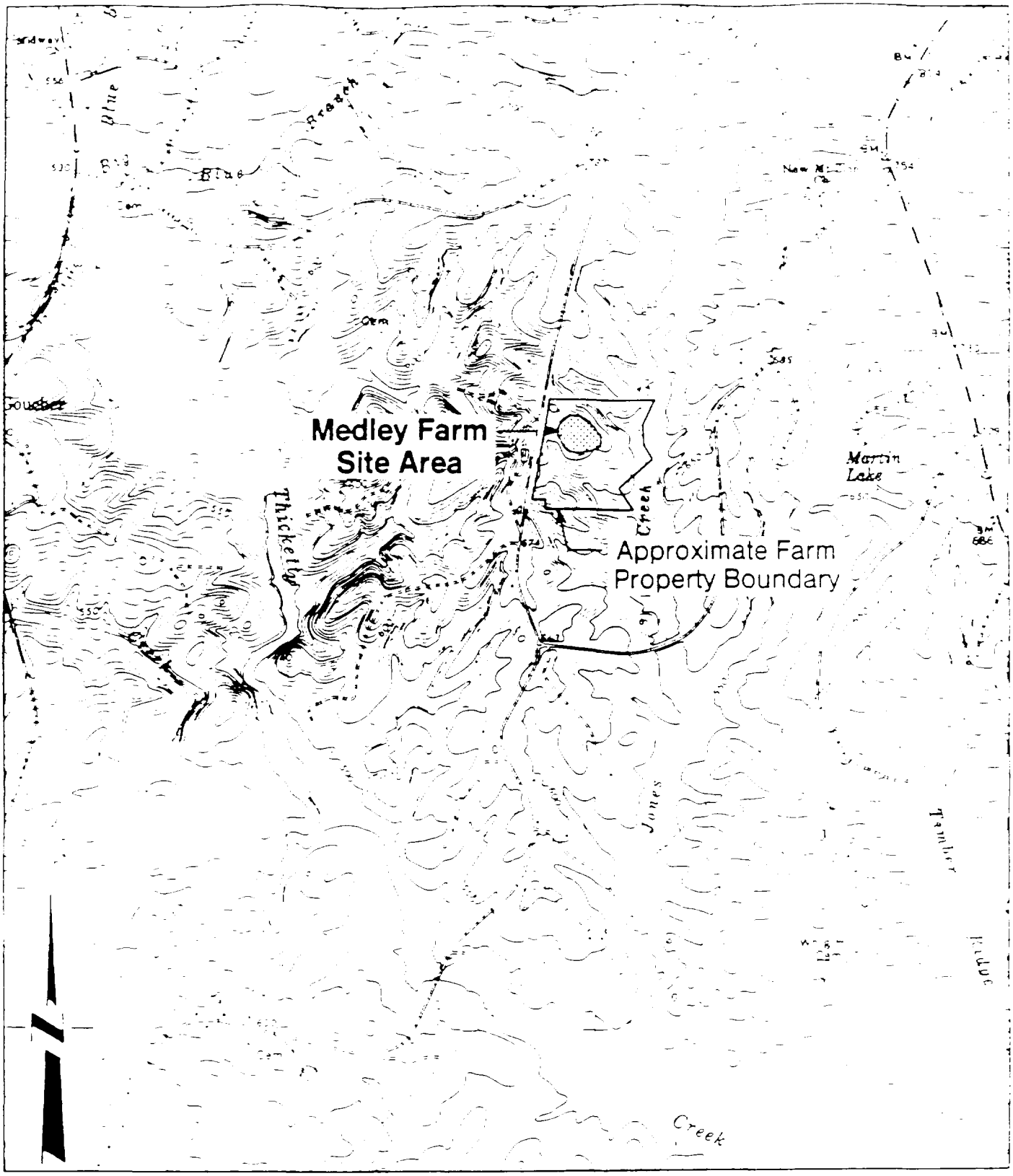


Figure 1
Medley Farm Site
Cherokee County
Gaffney, South Carolina



USGS Pacolet Mills Quadrangle

Scale 1:24,000

Figure 2

Approximate Boundaries of Medley Farm Site and Farm Property

Medley Farm Site Gaffney, South Carolina

5 9 0021

the south and southwest into two intermittent tributaries of Jones Creek. All surface drainage eventually discharges to Jones Creek which in turn flows into Thicketty Creek approximately 1.5 miles from the Medley property. Figure 3 shows the topography of the Medley Farm property, the Medley Farm site, and the surrounding area as well as the location of Jones Creek and the two intermittent tributaries. One of the tributaries is to the northeast of the Site and the other tributary is to the south.

Figure 4 shows the location of private wells within a one mile radius of the Site as well as the municipal water lines supplied by Dyratonville Water Works. All residents in the near vicinity of the Site are attached to the public water distribution system. Natural resources in the area of the Site include water, soils, flora and fauna. Jones Creek has minimal recreational value due to its size and poor accessability. Base flow in Jones Creek near the Site is 200 gallons per minute (gpm).

3.0 SITE HISTORY

The Medley Farm property is currently owned by Ralph C. Medley, who acquired the property from William Medley in 1948. Prior to the mid 1970's, the property was maintained as wood and pasture land. Based on available information, the disposal of drummed and other waste materials began at the Site in 1973 and was terminated in June of 1976. As a result of an anonymous call, the South Carolina Department of Health and Environmental Control (SCDHEC) visited the Site on May 3, 1983. At the time of the visit, SCDHEC estimated that approximately 2,000 55-gallon drums were on-site in scattered, random fashion. Drums were found in open pits, several small lagoons, and on the ground. These drums were in various stages of deterioration. Other notes/observations made during the May 3, 1983 SCDHEC visit included: a chemical odor in the air, a number of shallow excavations (pits) containing discolored standing water, drums standing or lying in the water in these pits, and areas of stressed vegetation. In addition to the 55-gallon drums, there were numerous plastic containers of various sizes. No formal records of disposed waste materials were maintained by the PRPs.

Based on this visit/inspection, SCDHEC returned on May 19, 1983 to collect soil samples for analysis. The results of these analyses showed the presence of a number of volatile organic compounds (VOCs) including methylene chloride, trichloroethylene (TCE), trans-1,2-dichloroethylene as well as several semivolatile organic compounds (SVOCs).

SCDHEC informed the Environmental Protection Agency (EPA) of the sampling results and EPA visited the Site during the week of May 30, 1983. During the EPA visit, additional samples were collected for analysis. Among the contaminants detected in EPA's samples were: methylene chloride, vinyl chloride, perchloroethylene (PCE), phenol, toluene, TCE, and 1,2-dichloroethane. One composite soil sample contained polychlorinated biphenyls (PCBs) at low levels.

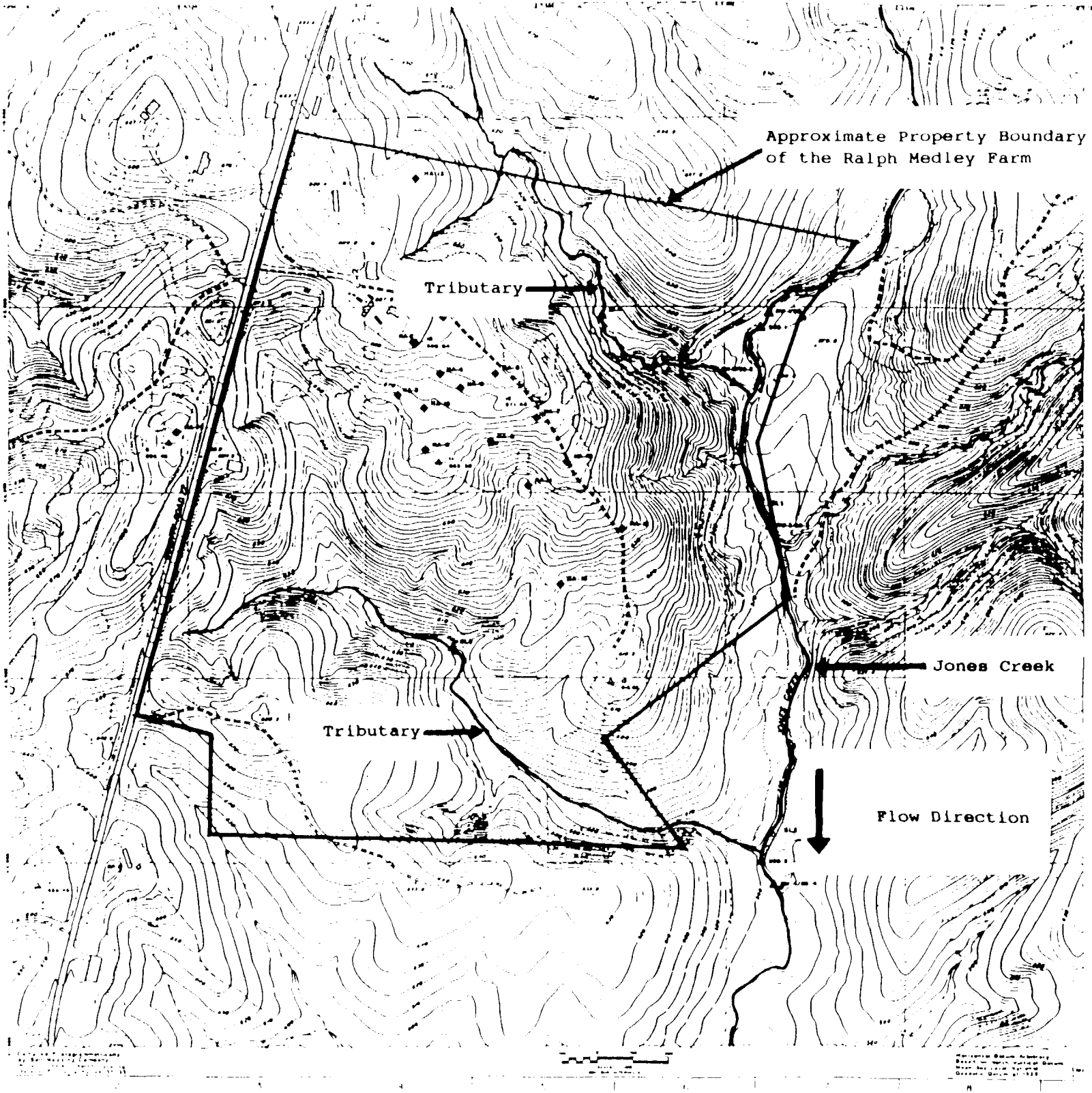
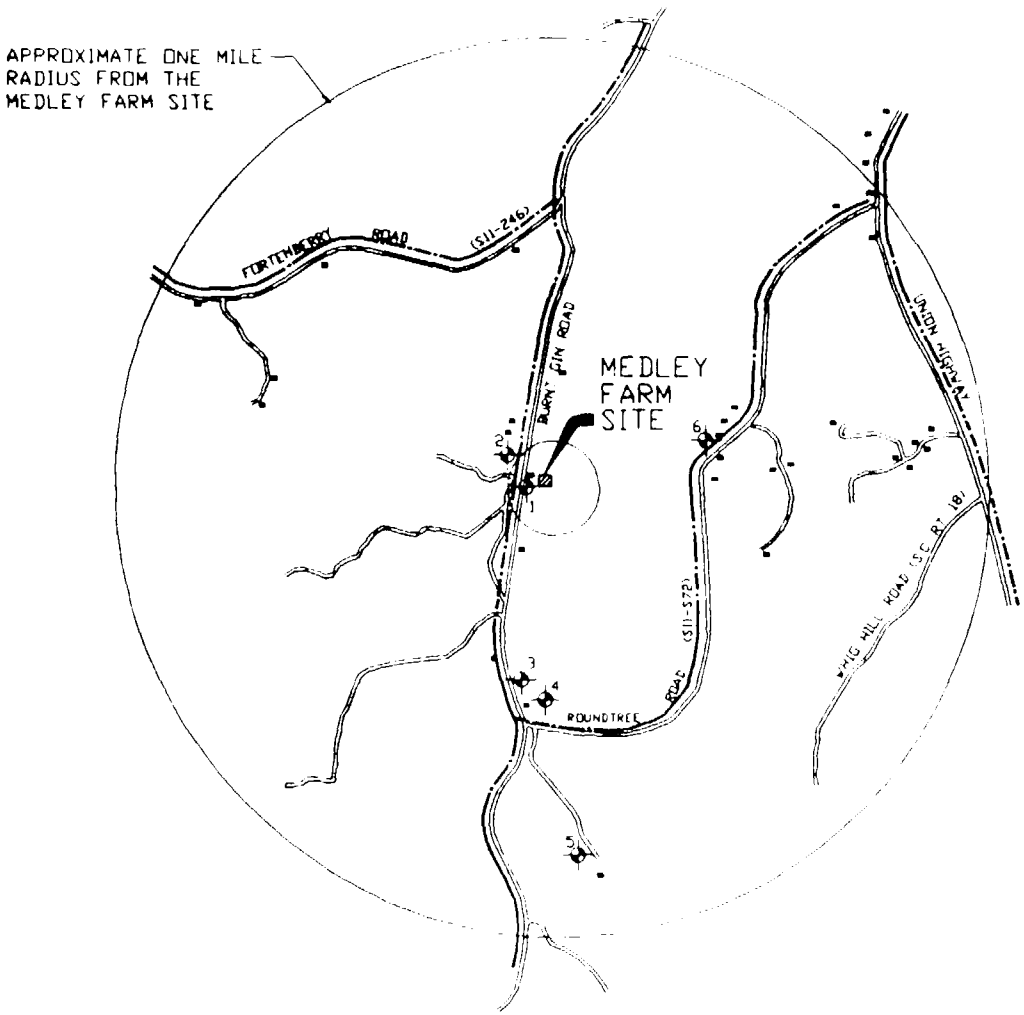


FIGURE 3

TOPOGRAPHY
OF SITE AN
SURFACE
STREAMS



LEGEND

- APPROXIMATE LOCATION OF MEDLEY FARM SITE
- APPROXIMATE LOCATION OF WATER SUPPLY WELLS ON RECORD WITH S.C. DHEC AND S.C. WRC. OWNERS OF RECORD ARE IDENTIFIED AS FOLLOWS:
  1. RALPH MEDLEY
  2. DOROTHY SPROUSE
  3. JAN SARRETT
  4. DAVIS FAMILY
  5. ROBERT PITTMAN
  6. ROBERT SOLESBEE
- APPROXIMATE LOCATION OF MUNICIPAL WATER SUPPLY LINES
- APPROXIMATE LOCATION OF BUILDINGS SHOWN ON USGS TOPOGRAPHIC MAP

NOTES

1. LOCATION OF WATER SUPPLY WELLS OBTAINED FROM THE SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL AND THE SOUTH CAROLINA WATER RESOURCES COMMISSION BY SIRRINE, NOV. 1990. A DOOR-TO-DOOR SURVEY WAS NOT PERFORMED FOR THIS STUDY.

2. LOCATION OF WATER LINES SUPPLIED BY GRANTSVILLE WATER WORKS, INC., NOV. 1990.

3. LOCATIONS OF BUILDINGS TAKEN FROM USGS TOPOGRAPHIC MAP, PAGELET MILES QUADRANGLE, 1968.

FIGURE 4
MUNICIPAL WATER SUPPLY AND DOMESTIC WELLS IN VICINITY OF MEDLEY FARM SITE

5 9 0024

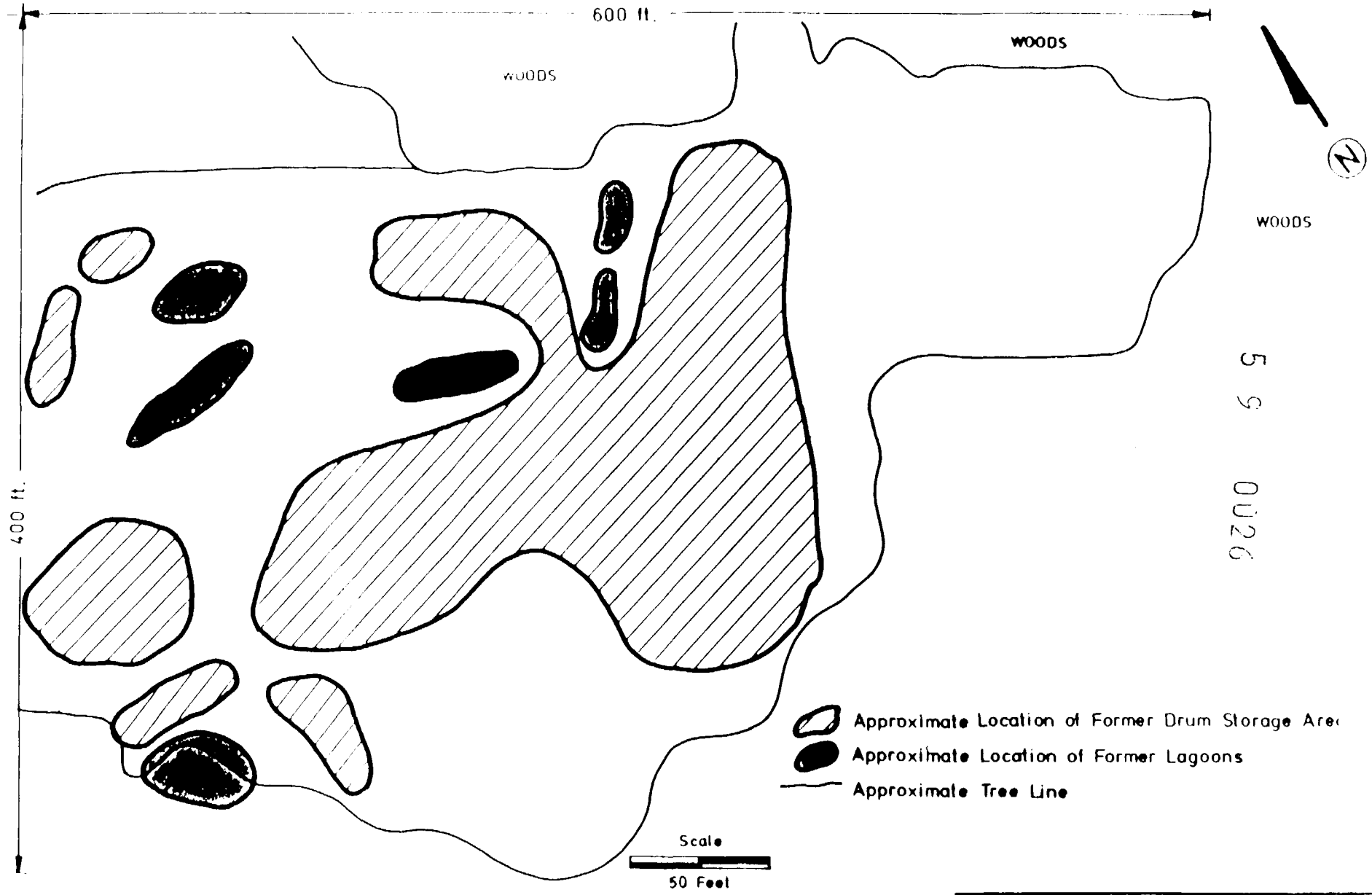
An immediate removal action was initiated on June 20, 1983 by EPA pursuant to Section 104 and other provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). A total of 5,383 55-gallon drums and 15-gallon containers were removed from the Site. These included full, partially full, and empty containers. Compatibility testing of drum contents was done prior to bulking of liquid wastes. Empty drums were crushed and taken to a sanitary landfill. The bulked liquids (24,000 gallons) were taken off-site by tanker and incinerated. The solid waste and contaminated soils, totaling 2,132 cubic yards, were taken to an approved hazardous waste landfill. Three drums containing PCBs (Arochlor 1254, 1260, and 1248) were over packed and sent to an approved disposal facility. Approximately 70,000 gallons of water were drained from the six small lagoons and treated in a pressurized sand/gravel/activated carbon filtration system for the removal of organics. The treated effluent was analyzed to ensure that it met State discharge standards prior to release into Jones Creek. The lagoons were backfilled with reportedly clean earth and graded to the natural topography. The remedial action was completed on July 21, 1983.

Analytical testing of the drum contents, as well as the water and sediment in the lagoons during the removal action, confirmed the presence of the following contaminants: toluene, benzene, methylene chloride, PCE, and vinyl chloride. Samples from adjacent homeowners' wells were collected by SCDHEC on June 27, 1983 and a trace level of methylene chloride was detected in the Sprouse well.

Following the removal action, the Agency directed one its Contractors to conduct a geological and geophysical study. This study was completed the week of August 1, 1983. The study was designed to determine the potential of groundwater contamination at the Site. The field study included electrical resistivity soundings, a magnetometer survey, and an electromagnetic (EM) survey. Anomalous areas identified by these geophysical surveys are illustrated in Figure 5. These anomalies correlated well with the former drum storage and lagoon locations.

SCDHEC revisited the Site in April 1984 to perform a preliminary investigation and install a monitoring well. Soil samples from two boreholes and a groundwater sample collected from the newly installed monitoring well were analyzed for volatile organics, primary metals, and acid and base-neutral extractables. The results of the soil analyses showed the presence of two quantifiable VOCs at a depth of 10 feet; the VOCs are methylene chloride at 81.4 micrograms per kilogram (ug/kg) and 1,2-dichloroethane at 102 ug/kg. Results of the groundwater analysis for VOCs for samples collected in April 1984 and July 1984 are presented in Table 1. This table also provides the analytical results for groundwater samples collected from the Sprouse well.

The Medley Farm site was subsequently evaluated by the EPA in June 1985, using the HRS. A migration score of 31.58 was assigned based entirely on the groundwater route. The Site was proposed for addition to the NPL in June 1986. In March 1990, the Site was finalized on the NPL and was ranked 850 (Federal Register, March 14, 1990). As of August 1990, the Site was ranked 918 on the National Priority List (Federal Register, August 30, 1990).



Source: NUS Report on Geophysical Study TDD No. F4-8307-03

Figure 5
Medley Farm Site RI
Summary NUS Electromagnetic Survey Results
Gaffney, South Carolina

5 9 0027

Table 1

Medley Farm Site RI
SCDHEC Volatile Organic Ground-Water Analyses

SCDHEC MONITORING WELL ON THE MEDLEY FARM SITE:

	Well MD2A	Date of Collection April 13, 1984 (1)	July 18, 1984 (2)
1)	methylene chloride	39.05 ug/L	9.22 ug/L
2)	1,1-dichloroethene	1,887.00 ug/L	1,645.00 ug/L
3)	1,1-dichloroethane	160.5 ug/L	43.7 ug/L
4)	trans-1,2-dichloroethene	37.9 ug/L	28.0 ug/L
5)	chloroform	8.0 ug/L	3.56 ug/L
6)	1,2-dichloroethane	22.05 ug/L	7.53 ug/L
7)	1,1,1-trichloroethane	3,362.00 ug/L	2,188.00 ug/L
8)	carbon tetrachloride	3,804.00 ug/L	830.00 ug/L
9)	trichloroethene	6.6 ug/L	3.14 ug/L
10)	1,1,2-trichloroethane	66.9 ug/L	15.3 ug/L
11)	toluene	29.6 ug/L	*
12)	perchloroethylene	2.5 ug/L	*

DOMESTIC WATER WELL IN MEDLEY FARM SITE VICINITY:

	Scrouse Well (2)	Date of Collection June 27, 1983(2)	September 12, 1983 (2)	July 18, 1984 (2)
1)	methylene chloride	14.0	0	678 ug/L
2)	1,2-dichloroethane	*	*	2.51 ug/L

* - No value given in SCDHEC analytical results.

References: 1. Workman, 1984(a)
2. Workman, 1984(b)

4.0 ENFORCEMENT ACTIVITIES

As a result of SCDHEC's May 1983 investigation and EPA's June 1983 investigation, EPA initiated a removal action between June 1983 and July 1983. The removal action was conducted under the authority of Section 104 of CERCLA. The cost of the removal action was approximately $675,000.

In 1983, EPA sent general notice letters, which included information requests pursuant to Section 104(e) of CERCLA to 22 companies. The vast majority of these companies were identified by drum labels found at the Site. In response to the information requests, most of the companies alleged that they had never had any contact or dealings with the Site or the owners/operators thereof and that their product drums must have been re-used by their customers without removing the labels.

In May 1985, EPA sent additional general notice and information request letter to eight parties which were identified as PRPs through interviews with the owners and operators and other witnesses.

In October 1985, EPA sent demand letters to Unisphere Chemical Corp., Milliken Chemical Company, National Starch and Chemical Company, Ralph C. Medley, Clyde Medley, and to other parties involved in this case.

In June 1986, pursuant to Section 107 of CERCLA, the United States filed a complaint in a cost recovery action against the owner of the Site, Ralph C. Medley, and the following members of his family: Clyde Medley, Grace Medley, and Barry Medley (individually and doing business as Medley Concrete Works). The complaint also named the following generators, who were believed to have shipped waste to the Site, as defendants:

1. Milliken and Company
2. National Starch and Chemical Corporation
3. Unishpere Chemical Corporation.

In a third-party complaint, the original defendants alleged that the following companies also had sent hazardous substances to the Site and were liable as generators under CERCLA Section 107, 42 U.S.C. § 9607:

1. ABCO Industries, Incorporated
2. BASF Corporation
3. Ethox Chemicals, Incorporated
4. Polymer Industries, a division of Morton-Thiokol
5. Tanner Chemical Company.

After conducting approximately six months of discovery, the United States moved for partial summary judgement on the issue of the defendants' liability. By way of an Order, dated November 5, 1986, the Court granted the government's motion for summary judgement, finding the defendants Ralph C. Medley and Clyde Medley liable for all costs incurred by the United States in responding to the release or threatened release of hazardous substances at the Site, as well as for any future response costs which the United States might incur.

After several months of negotiations, the United States and the generator defendants reached an agreement requiring the payment of $560,000, which was approximately 83 percent of the past costs incurred by the United States in the removal action. The agreement was memorialized in a Consent Decree, dated June 30, 1987, filed with the United States District Court for the District of South Carolina, Spartanburg Division (Civil Action No. 86-252-3). The Consent Decree did not include the Medley family owner/operators.

Thereafter, the generators and the United States filed a Stipulation of Dismissal with the District Court, which provided for the dismissal of the United States' suit against the Medleys, both individually and doing business as Medley's Concrete Works, for the response costs incurred by the United States up to and including the date of entry of the Consent Decree. Since the Stipulation of Dismissal was without prejudice and it provided for the tolling of the statute of limitations, the United States preserved its ability to pursue the Medleys at a later time.

In July 1987, EPA sent special notice letters pursuant to Section 122(e) of CERCLA to initiate the moratorium period in connection with the conduct of the RI/FS to the following parties:

1. Unishpere Chemical Corporation
2. Milliken and Company
3. Tanner Chemical Company
4. Charles S. Tanner Company
5. Polymer Industries
6. National Starch and Chemical Corporation
7. Ralph C. Medley
8. Grace Medley
9. Clyde Medley
10. Barry Medley
11. Medley Concrete Works
12. Ethox Chemicals, Incorporated
13. BASF Corporation
14. ABCO.

A steering committee of PRPs was formed following the issuance of the special notice letters. The steering committee made a good faith offer to conduct the RI/FS by means of a letter to Region IV, EPA dated November 2, 1987. The parties thereafter entered into an Administrative Order by Consent, dated January 29, 1988, for conduct of the RI/FS.

5.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Information Repositories/Administrative Records for this Site were established at the Cherokee County Public Library in Gaffney and in the EPA, Region IV Regional Information Center in Atlanta, Georgia. A Community Relations Plan identifying a proactive public outreach strategy was developed at the direction of EPA Region IV staff and submitted to the information repositories prior to initiating RI field work. The following describes the community relations activities conducted by the Agency for this Site.

Two Fact Sheets were distributed to the public during the latter part of 1988. The first Fact Sheet, released in October 1988, provided pertinent background and historical information, and a brief description of the Superfund process. This Fact Sheet also informed the public that an Information Repository for the Medley Farm site had been established.

The second Fact Sheet, distributed in December 1988, described the upcoming RI field activities and provided a schedule of work. The "Kick-Off" public meeting was held on January 9, 1989. In each Fact Sheet and the "Kick-Off" meeting, the Agency highlighted the opportunities for public involvement and encouraged the public to become and remain involved with the Superfund process at the Medley Farm site.

Following the submittal of the draft RI report to the Agency by the PRPs on March 30, 1990, a third Fact Sheet was prepared. This Fact Sheet, distributed in May 1990, highlighted the findings/conclusions stated in the draft RI report. A public meeting was held on May 24, 1990 to share with the public the information presented in the draft RI and inform the public of the upcoming activities and provide a schedule for these activities.

Due to the data deficiencies identified in the draft RI report, a fourth Fact Sheet was mailed out to inform the public that a second phase, Phase II, of the RI was necessary. This Fact Sheet briefly explained why there was a need for Phase II, the field activities associated with this Phase, and a revised schedule. Following the completion of Phase II and the submittal of the revised RI report on November 30, 1990, another Fact Sheet was prepared and distributed to the public in January 1991. This Fact Sheet highlighted the findings/conclusions stated in the revised RI report. Shortly after distributing this Fact Sheet, the Proposed Plan Fact Sheet was sent out to the public on February 8, 1991. The information included in the Proposed Plan was based on the draft FS document submitted to the Agency by the PRPs on December 31, 1990.

The public was informed through the Proposed Plan Fact Sheet and a public notice released by the Agency of the February 12, 1991 Proposed Plan public meeting. The primary goals of this meeting were to review the remedial alternatives developed by the PRPs, identify the Agency's preferred alternative, provide the Agency's rationale for the selection of this alternative, encourage the public to voice their opinion with respect to the Agency's selection or any other issue, and inform the public that the public comment period on the Proposed Plan would run from February 13, 1991 to March 12, 1991. The public was also informed that all comments received during the

public comment period would be addressed in the Responsiveness Summary which is an Appendix of the ROD.

The public comment period was extended an additional 30 days in response to a request for an extension dated February 5, 1991. This extension is in accordance with the National Contingency Plan, C.F.R. § 300.430(f)(3)(i)(C). As a result of this extension, the public comment period ended on April 13, 1991. The public was informed of this extension through a public notice in a local newspaper and by means of a short Fact Sheet.

6.0 SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

The intent of this remedial action presented in this ROD is to eliminate future risks at this Site. This remedial action will remove the threat posed by contaminated groundwater at the Site and remediate residual soil contamination. Remediating residual soil contamination will prevent residual contamination from adversely impacting groundwater and decrease the future risk associated with Site soils. This is the only ROD contemplated for the Site. No other operable units have been identified at this Site.

7.0 SUMMARY OF SITE CHARACTERISTICS

The RI found that the Medley Farm site is contaminated as follows; by VOCs, SVOCs, and PCBs in surface and subsurface soils beneath the former disposal areas; and VOCs in the groundwater beneath and downgradient of the former disposal areas. No contaminants were detected above Contract Laboratory Program (CLP) Contract Required Quantification Limits (CRQLs) in surface water or sediment samples. Concentrations of inorganics detected in all environmental media were consistent with naturally occurring levels found in the vicinity of the Site as demonstrated by the analyses of background samples. Background samples were collected for surface and subsurface soils, groundwater, and surface water and sediment.

PCBs were detected at low levels in surface soils and composite samples of residual wastes and soils collected from test pits. The highest detected concentrations of PCBs at the Site were in subsurface soil samples collected from test pits 2 and 11. A concentration of 5.379 milligrams per kilogram (mg/kg) was encounter in TP-2 and 2.442 mg/kg in sample designated TP-11. The highest surface soil concentration of PCB, 1.9 mg/kg, was found at sampling location HA-8. These concentrations are below the Toxic Substances Control Act (TSCA) PCB Cleanup Policy level of 10 mg/kg or parts per million (ppm). No PCBs were detected in groundwater.

Residual source materials remaining at the Site are restricted to very small, limited areas and found only where former lagoons were once located. When found, such materials consist of thin, isolated pockets of sludges and debris.

Contaminants present in the soils represent limited areas of direct, mostly shallow disposal. Soil borings and test pits were installed to investigate suspected lagoon and drum disposal areas. The primary contaminants observed in soils at the Site are VOCs. The most significant occurrence of VOCs correlate well with former lagoon locations and areas where heavy concentrations of drums were stored (refer to Figure 5).

The total volume of contaminated soils present at the Site is approximately 53,000 cubic yards. This volume is based on the area of the Site, as defined in Figure 6, and the depth down to groundwater which is approximately 60 feet. The total volume of groundwater impacted by the former disposal activities at this Site is estimated to be 24.1 million gallons.

7.1 RESIDUAL SOURCE MATERIALS

Numerous test pits (refer to Figure 7) were excavated during the RI field work to allow for source characterization and visual observations of the underlying soil. Evidence of former lagoons were observed in test pits TP-3, TP-4, TP-5, TP-7, TP-12, and TP-14. The evidence consisted of thin, isolated pockets of sludge overlying matted vegetation, and other residual waste materials. This material was typically encountered at depths of one-half to two feet below ground surface. No other residual waste materials were encountered in the trenches excavated for source characterization except for occasional pieces of scattered debris such as plastic sheeting and rusted drum fragments.

Shallow soil samples were also collected from the test pits. These samples provided additional analytical data to help characterize the Site. Figure 7 provides the locations of the test pits, the VOCs detected in a particular test pit, and the concentration of each VOC detected. Figure 8 provides the same degree of information as does Figure 7, but for SVOCs, pesticides, and inorganics.

7.2 SOILS

Tables 2, 3, and 4 identify the organic contaminants detected in the soil at the Medley Farm site for samples collected from test pits, soil borings, and the surface. These tables also provide the concentration encountered at each sampling point. Table 2 lists the contaminants encountered in the test pits and Table 3 lists the contaminants detected in samples collected from the soil borings. Table 3 also provides the depths the samples were collected. The analytical results for contaminants found in surface soil samples are furnished in Table 4.

Table 5 lists the frequency of detection and the range of concentrations detected for contaminants found in the soil at the Medley Farm site. Those compounds listed in Table 5 which are marked with an asterisk were identified as chemicals of potential concern. A chemical of potential concern is

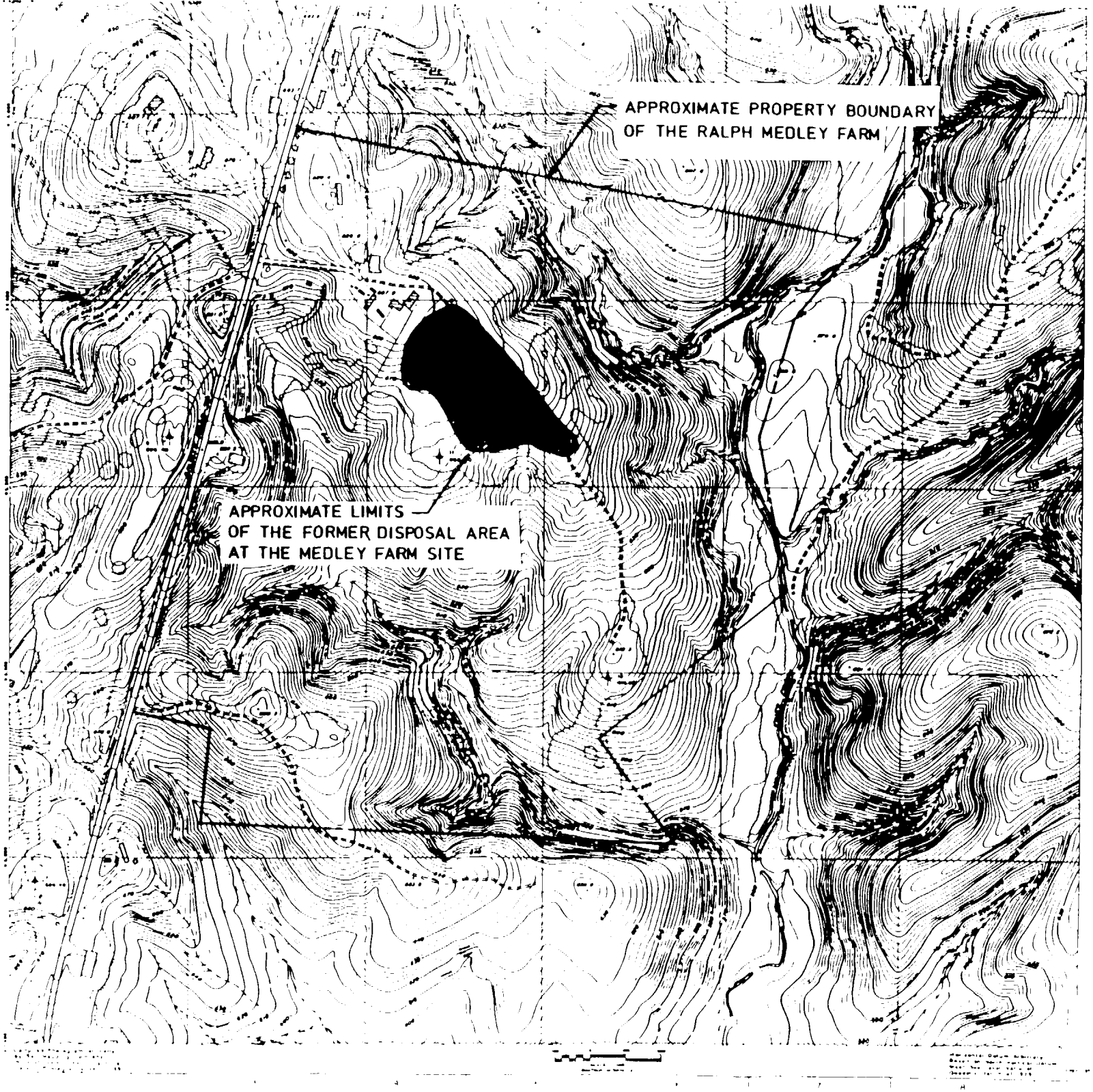


FIGURE 6

APPROXIMATE BOUNDARY OF DISPOSAL AREA

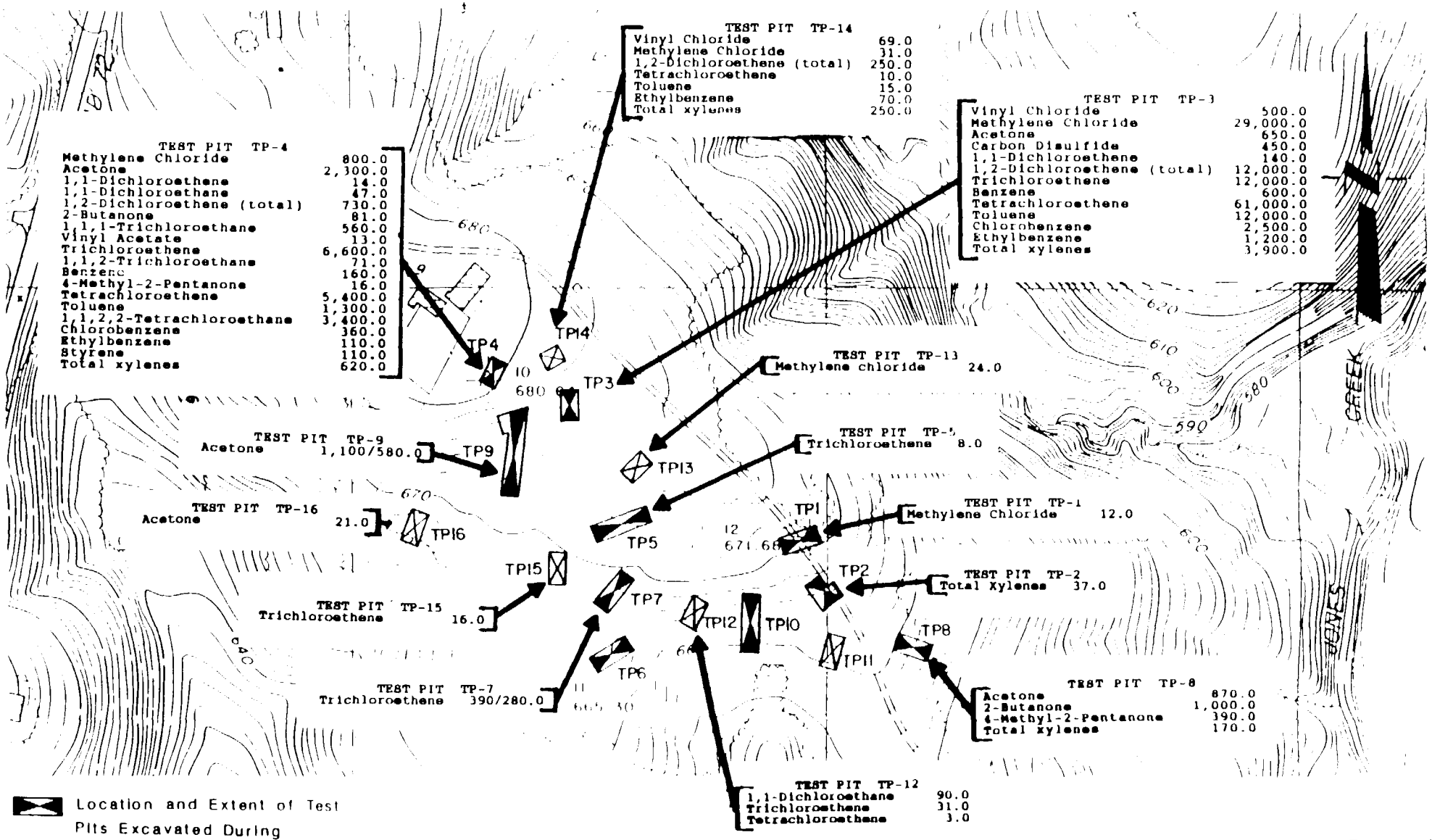


Figure 7

Volatile Organic Compounds Found in Test Pits

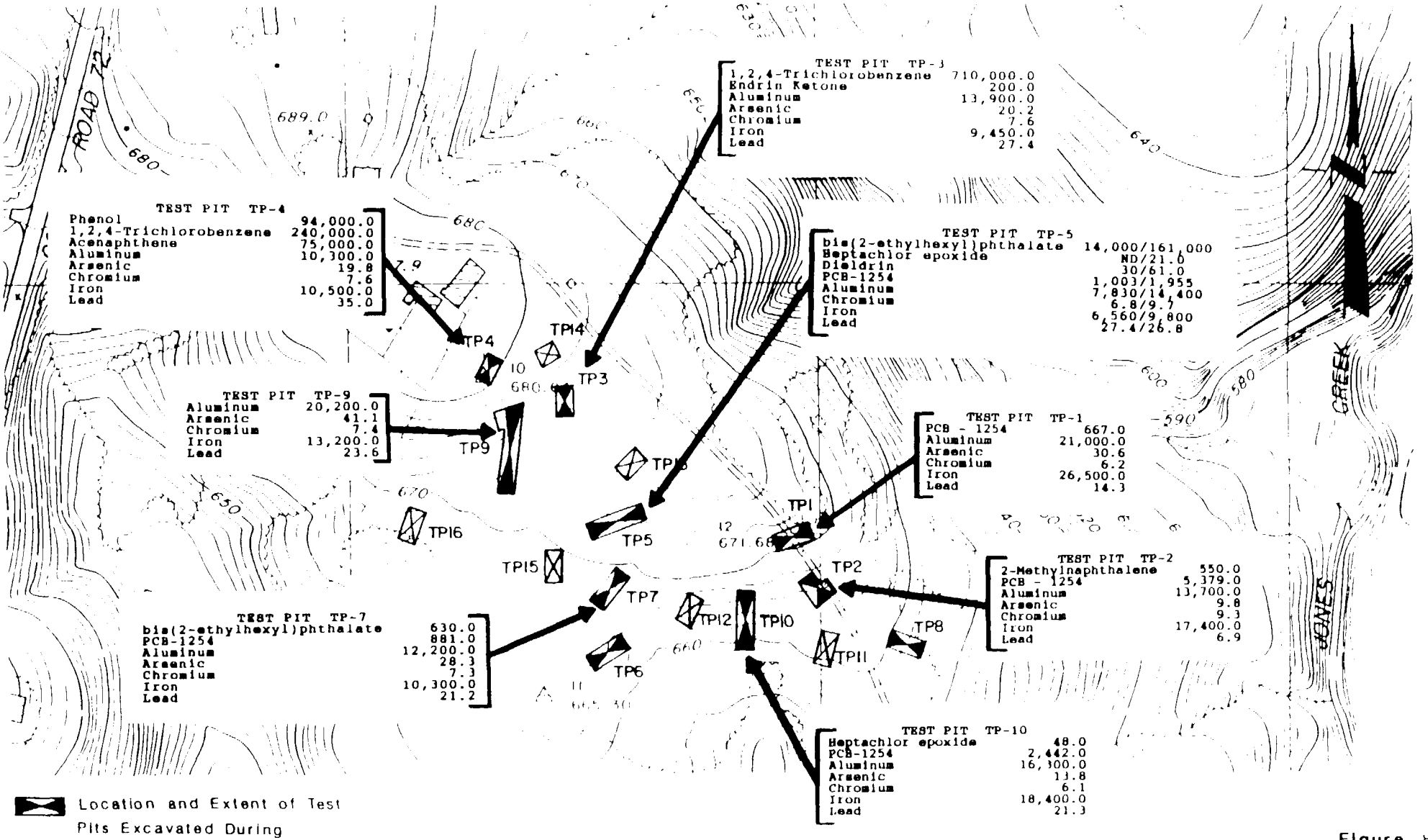


Figure 8

Semi-Volatile Organic Compounds Found In Test Pits

TABLE 2
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOILS (ug/kg)

SAMPLE ID COMPOUND	TP1-1	TP2-1	TP3-1	TP4-1	TP5-1	TP7-1	TP8-1	TP9-1	TP12-1	TP13-1	TP14-1	TP15-1
1,1-Dichloroethene			140 E	14								
1,1-Dichloroethane				47								
1,1,1-Trichloroethane				560 E								
1,1,2-Trichloroethane				71								
1,1,2,2-Tetrachloroethane				3400 E								
1,2-Dichloroethane									90			
1,2-Dichloroethene (total)			12000 E	730 E							250	
2-Butanone				81			1000					
4-Methyl-2-pentanone				16			390					
Acetone	12			2300 E			870	580 DE				
Benzene			600 E	160								
Carbon Disulfide			450 E									
Chlorobenzene			2500 E	360 E								
Ethylbenzene			1200 E	110							70	
Methylene Chloride				800 E						24	31	
Styrene				110								
Tetrachloroethene (PCE)			61000 E	5400 E					3 J		10	
Toluene			12000 E	1300 E							15	
Trichloroethene			12000 E	6600 E	8	280 D			31			16
Vinyl Acetate				13								
Vinyl Chloride			500 E								69	
Xylene (Total)		3.7	3900 E	620 E			170				250	

Data Flags:

D- Sample diluted for this analyte

E- Estimated result. Analyte concentration exceeded the instrument calibration range.

Notes:

No volatile organic compounds were detected in soil samples collected from test pits TP6, TP10, TP11, and TP16.

TABLE 2 (continued)
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOILS (ug/kg)

SAMPLE ID COMPOUND	TP2-1	TP3-1	TP4-1	TP5-1	TP7-1
2-Methylnaphthalene	550				
1,2,4-Trichlorobenzene		710000 D	240000 D		
Acenaphthalene			75000		
Phenol			94000 D		
Bis(2-Ethylhexyl)phthalate				161000	630

Data Flags:
D - Sample diluted for this analyte.

Notes:
No semi-volatile organic compounds were detected in soil samples collected from test pits TP1 and TP9.
Soil samples collected from test pits TP6 and TP8 were not analyzed for semi-volatile organic compounds.

TABLE 3
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOILS (ug/kg)

1,1,2,2 TETRACHLOROETHANE

Sample Depth	Soil Boring Number SB2	SB5	SB6
5 - 7'	*	nd	6
10 - 12'	710 D	nd	*
15 - 17'	97 D	9	nd
25 - 27'	74 D	nd	nd

METHYLENE CHLORIDE

Sample Depth	Soil Boring Number SB3	SB4
5 - 7'	*	*
10 - 12'	50	10
15 - 17'	nd	32
25 - 27'	nd	17

CHLOROFORM

Sample Depth	Soil Boring Number SB2	SB6
5 - 7'	*	13
10 - 12'	600 D	*
15 - 17'	nd	nd
25 - 27'	nd	nd

TRICHLOROETHENE

Sample Depth	Soil Boring Number SB4	SB7
5 - 7'	*	24
10 - 12'	19	*
15 - 17'	32	nd
25 - 27'	17	nd

1,2-DICHLOROETHANE

Sample Depth	Soil Boring Number SB4	SB7	SB9	SB10
5 - 7'	*	97	*	23
10 - 12'	3700 D	*	47	*
15 - 17'	4500 D	nd	32	nd
25 - 27'	680 D	nd	99	nd

Data Flags:
D- Sample diluted for this analyte.
E - Estimated result. Analyte concentration exceeded the instrument calibration range.

Notes:
nd - Not detected
* - Not analyzed.

2-Butanone was detected in boring SB2 at 15 - 17' at 90 ug/kg in the diluted sample.
1,2-Dichloroethene (total) was detected in boring SB3 at 10 - 12' at 17 ug/kg.
PCE was detected in boring SB7 at 5 - 7' at 12 ug/kg.
Results are reported only for borings in which analytes were detected. Complete tables of analytical results are provided in Appendix I

TABLE 3 (continued)
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOIL (ug/kg)

ACETONE

Sample Depth	Soil Boring Number SB2	SB3	SB4	SB5
5 - 7'	•	•	•	nd
10 - 12'	18000 DE	140	200	21
15 -17'	7300 DE	55	1900 D	570 D
25 - 27'	750 D	16	100	nd

ACETONE (continued)

Sample Depth	Soil Boring Number SB6	SB7	SB8	SB9	SB10
5 - 7'	58	4700 D	86	•	31
10 - 12'	•	•	•	94	4
15 -17'	nd	120	58	110	40
25 27'	nd	18	250 D	nd	65

Data Flags:
D Sample diluted for this analyte.
E - Estimated result. Analyte concentration exceeded the instrument calibration range.

Notes:
nd - Not detected
• - Not analyzed

2 Butanone was detected in boring SB2 at 15 - 17' at 90 ug/kg in the diluted sample.
1,2-Dichloroethene (total) was detected in boring SB3 at 10 - 12' at 17 ug/kg.
PCE was detected in boring SB7 at 5 - 7' at 12 ug/kg.
Results are reported only for borings in which analytes were detected. Complete tables of analytical results are provided in Appendix I.

TABLE 3 (continued)
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOIL (ug/kg)

1,2-DICHLOROBENZENE

Sample Depth	Soil Boring Number SB3
5 - 7'	*
10 - 12'	nd
15 - 17'	460
25 -27'	nd

NAPHTHALENE

Sample Depth	Soil Boring Number SB3
5 - 7'	*
10 - 12'	nd
15 - 17'	410
25 -27'	nd

PHENOL

Sample Depth	Soil Boring Number SB2
5 - 7'	*
10 - 12'	77000
15 - 17'	nd
25 -27'	690

1,4-DICHLOROBENZENE

Sample Depth	Soil Boring Number SB3
5 - 7'	*
10 - 12'	nd
15 - 17'	2300
25 -27'	nd

DIETHYLPHTHALATE

Sample Depth	Soil Boring Number SB3
5 - 7'	*
10 - 12'	nd
15 - 17'	nd
25 -27'	3200

BENZOIC ACID

Sample Depth	Soil Boring Number SB2
5 - 7'	*
10 - 12'	nd
15 - 17'	nd
25 -27'	2600

1,2,4-TRICHLOROBENZENE

Sample Depth	Soil Boring Number SB2	SB3
5 - 7'	*	*
10 - 12'	nd	700
15 - 17'	nd	12000
25-27'	5200	nd

Notes:
nd - Not detected
* - Not analyzed

Results are reported only for borings in which analytes were detected.
Complete tables of analytical results are provided in Appendix L.

TABLE 4
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
ORGANIC COMPOUNDS DETECTED
IN
SOILS (ug/kg) - See Note

SAMPLE I.D.	HA-1	HA-2	HA-3	HA-4	HA-5	HA-6	HA-7	HA-11	HA-6-A
PARAMETER									
1,1,2,2-Tetrachloroethane						91			85
1,1,2-Trichloroethane						160			110
1,2-Dichloroethene (total)	170	11		6			120		200
1,2-Dichloropropane							21		
Ethylbenzene				7				33	
Methylene chloride					6		23		
Styrene								11	
Tetrachloroethene					37	69			53
Trichloroethene	14					50	7		70
Vinyl chloride		25	25	28	210				

SAMPLE LOCATION	HA1	HA3	HA8	HA11
SAMPLE I.D.	HA1-2	HA3-2	HA8-2	HA11-2
PARAMETER				
Toxaphene	330			
PCB-1254		200	1900	430

SAMPLE I.D.	HA-6	HA-6 DILUTION	HA-11
PARAMETER			
1,2,4-Trichlorobenzene	990 @	1100 DJ	1200 @
bis(2-Ethylhexyl)phthalate	29000 E	33000 D	
Butylbenzylphthalate	900 @	1100 DJ	
Di-n-butylphthalate	930 @	1100 DJ	
Di-n-octylphthalate	5400	4900 D@	

Notes:
D - Sample diluted for this analyte.
J - Estimated result. Analyte detected at less than the sample quantitation limit.
E - Estimated result. Analyte concentration exceeded the instrument calibration range
@ - Estimated result less than 5 times the detection limit.

TABLE 5

CHEMICALS DETECTED IN SURFACE SOIL
MEDLEY FARM SITE

Chemical	Frequency of Detection	Contract Required Quantitation Limit (ug/kg)	Range of Detected Concentrations (ug/kg)[c]
Volatile Organic Compounds[a]			
*1,1,2-Trichloroethane	2/13	5	110-160
*1,1,2,2-Tetrachloroethane	2/13	5	85-91
*1,2-Dichloroethene (total)	6/13	5	4-200
*1,2-Dichloropropane	1/13	5	21
Chlorobenzene	1/13	5	3
Chloroform	1/13	5	3
*Ethylbenzene	2/13	5	7-33
*Methylene Chloride	11/13	5	2-23
*Styrene	2/13	5	3-11
*Tetrachloroethene	4/13	5	5-69
Toluene	1/13	5	1
*Trichloroethene	4/13	5	7-70
*Vinyl Chloride	4/13	10	25-210
Semi-Volatile Organic Compounds[b]			
1,2-Dichlorobenzene	2/15	330	190-200
*1,2,4-Trichlorobenzene	4/15	330	810-1200
2-Methylnaphthalene	2/15	330	140-160
*Butylbenzylphthalate	5/15	330	140-1100

TABLE 5 (Cont'd)

CHEMICALS DETECTED IN SURFACE SOIL
MEDLEY FARM SITE

*Di-n-butylphthalate	4/15	330	78-1100
*Di-n-octylphthalate	4/15	330	3600-5400
Diethylphthalate	1/15	330	110
*bis(2-Ethylhexyl)phthalate	6/15	330	82-33,000
Pesticides/PCB			
*Toxaphene	2/13	160	330-520[d]
*PCB-1254	3/13	160	200-1900

* Chemical of potential concern

[a]Volatile organic compounds and pesticides/PCB are based on data from the following samples: HA-1 thru HA-12, and HA-6-A.

[b]Semi-volatile organic compounds are based on data from the following samples: HA-1 thru HA-12, HA-6-A, HA-16, and HA-16-A.

[c]The range of detected concentrations include estimated results (chemical concentrations less than the contract-required quanitation limit).

[d]Duplicate samples taken at same location.

defined as any chemical detected at or above the CRQL at least once in a given environmental medium. As stated above, concentrations of inorganics detected in on-site soil samples were consistent with naturally occurring levels.

7.2.1 Surface Soils

VOCs and SVOCs were detected in surface soil samples. Figure 9 shows the locations where the surface soil samples were collected. This figure also lists the contaminants identified at each sampling location as well as the concentration of each identified contaminant.

PCBs were detected in several surface soil samples. These samples, with one exception, are considered to be essentially within the limits of the former disposal or drum storage areas at the Site. HA-11, the exception, was collected from an area which receives sediment runoff from the Site via erosion. Figure 10 shows the location and lists the associated concentration of PCBs found at the Site.

One pesticide was detected in one of the 15 surface soil samples. A trace level of Toxaphene at 330 ug/kg was found at sampling point HA-1.

7.2.2 Subsurface Soils

No vertical pattern of chemical distribution in subsurface soils is apparent. Elevated contaminant concentrations were generally found in samples collected from depths of less than 17 feet. Elevated levels of VOCs, however, were noted at depths as great as 27 feet in soil borings (SB) SB-2, SB-4, and SB-9. Low concentrations of SVOCs, ranging from no detection to 77,000 ug/kg, were observed in SB-2, SB-3, and SB-9.

Figure 11 specifies the soil boring locations, the VOC contaminants detected at each soil boring location, the concentrations of the contaminants encountered, and the depths the samples were collected. Figure 12 provides the same degree of information as Figure 11 does, but for SVOCs rather than VOCs. Figure 12 also furnishes background concentrations for several metals for samples collected from boring SB-1.

Due to the lack of steep topography in the immediate disposal areas, the vegetative cover, and the nature of chemical residuals at the Site, overland migration of residual chemicals away from the former disposal area was not significant. The immediate emergency removal action taken by EPA (June-July 1983) successfully removed the major portion of the source material and highly contaminated soils.

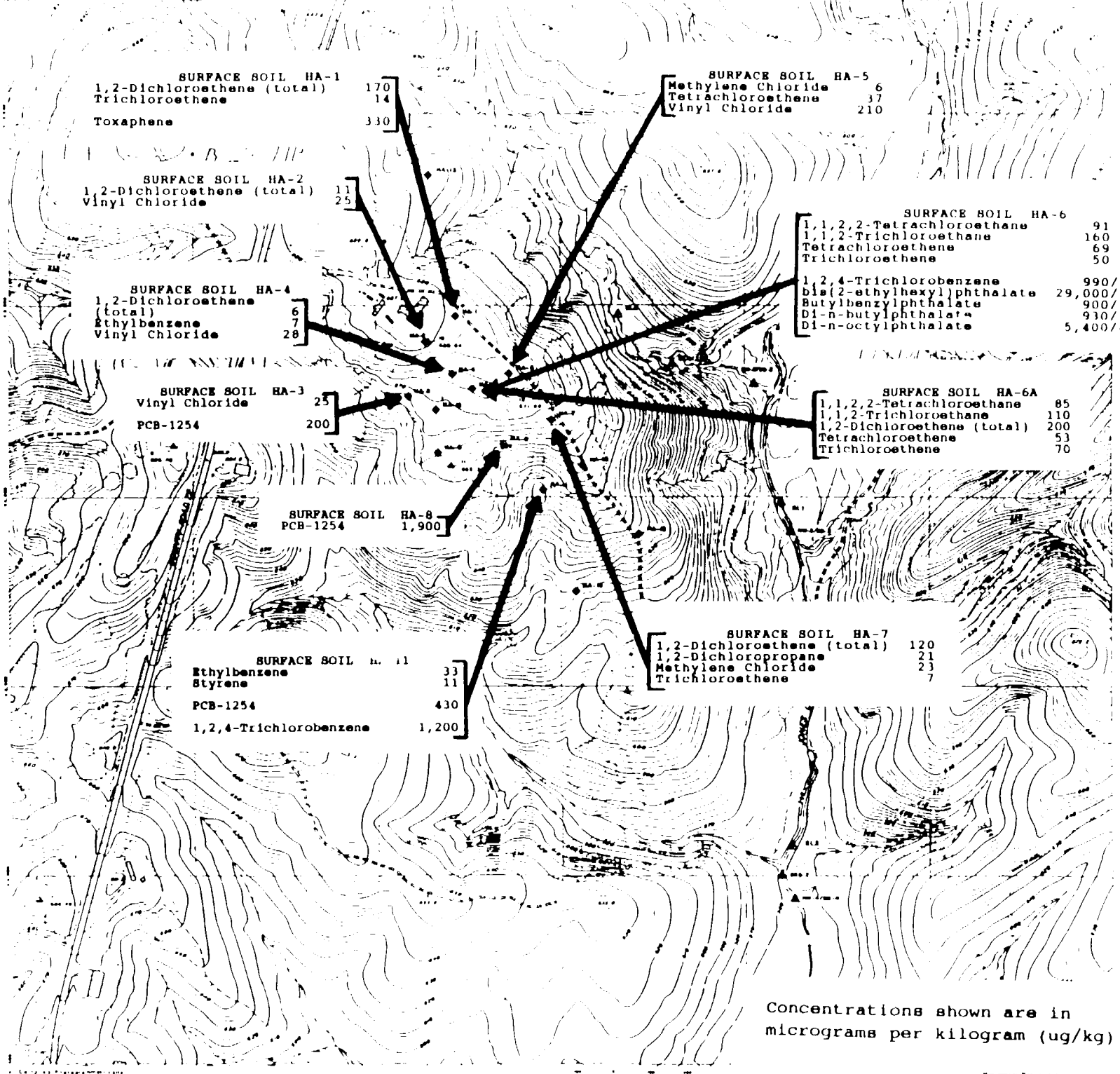


FIGURE 9

VOLATILE AND SEMI VOLATILE ORGANICS FOUND IN SURFACE SOIL (HA) SAMPLES

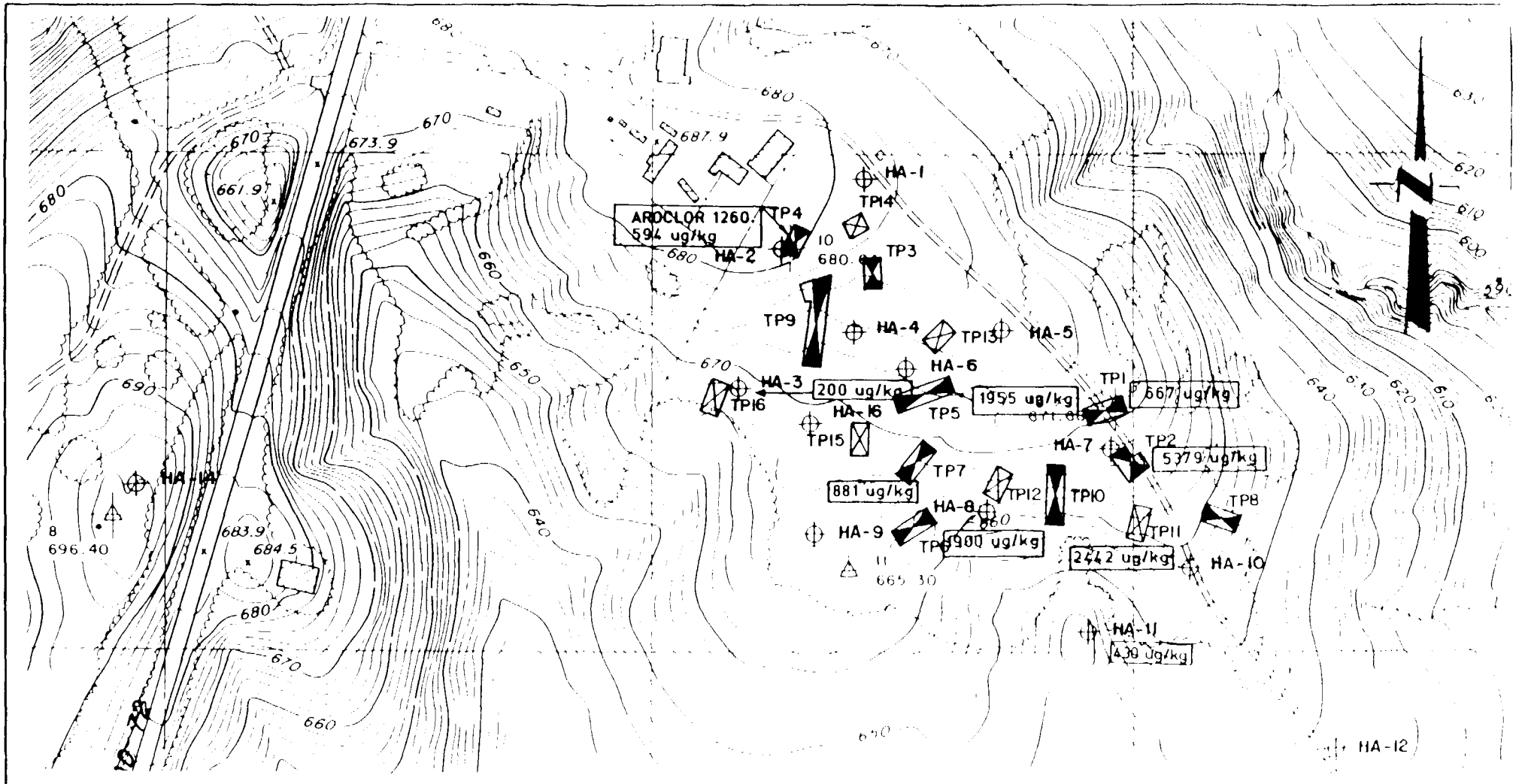
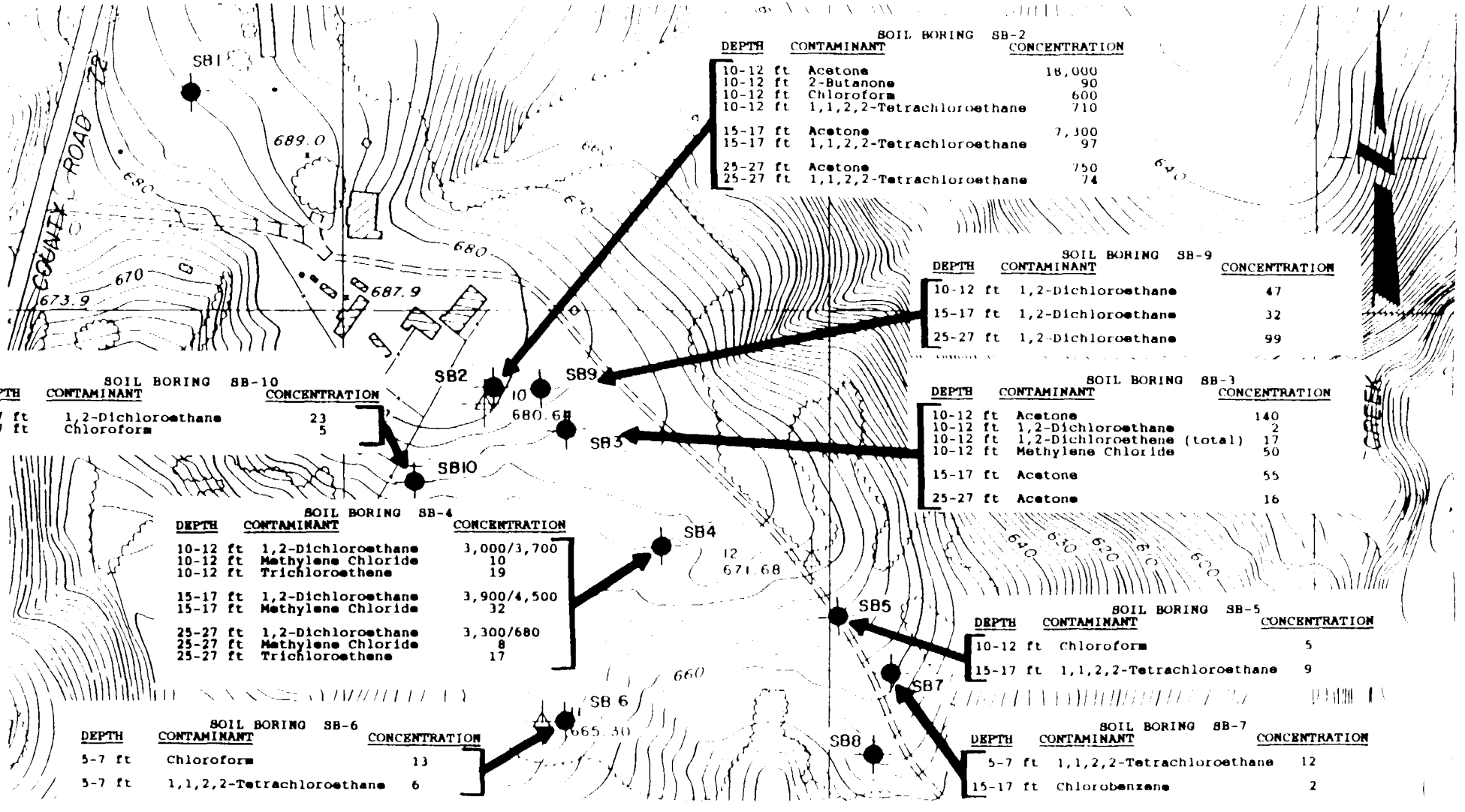


Figure 10

Concentrations of PCB's in Soil

Medley Farms Site
Gaffney, South Carolina

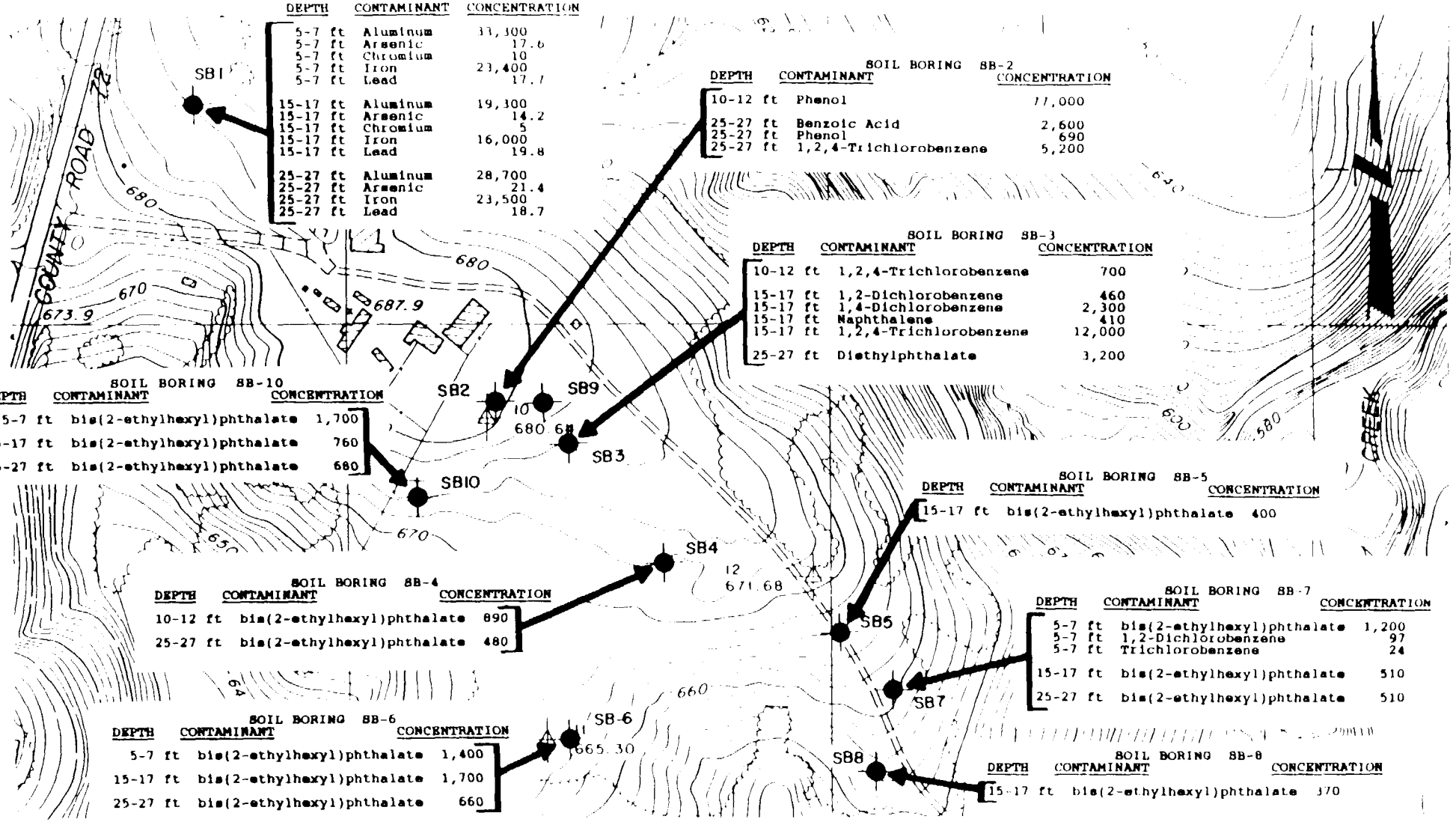


Location of Soil Borings Drilled During RI-Phase IB (Jan., 1990)

Concentrations shown are in micrograms per kilogram (ug/kg)

Figure 11

Volatile Organic Compounds Detected in Soil Samples from Soil Borings



Location of Soil Borings Drilled During RI-Phase IB (Jan., 1990)

Concentrations shown are in micrograms per kilogram (ug/kg)

Figure 1.2

Semi-Volatile Organic Compounds Detected in Soil Samples from Soil Borings

In summary, there appears to be no uniform vertical or horizontal distribution of the residual chemicals present in the soils at the Site. Instead, chemical residuals are concentrated in localized areas related to former direct disposal activities (lagoons and/or drum disposal areas), refer to Figure 5.

7.3 GROUNDWATER

Elevated concentrations of VOCs were noted in shallow monitoring wells (SW) SW-3, SW-4, BW-2, SW-108, and bedrock monitoring well (BW) BW-108. Trace levels of VOCs were detected in SW-101, BW-106, and BW-109. No SVOCs, pesticides, or PCBs were detected in groundwater. Samples collected from monitoring wells installed during Phase IA were analyzed for inorganics. Based on the analytical results, it was determined that any inorganics present in the groundwater were not Site-related.

Table 6 provides a comprehensive list of VOCs detected in the groundwater and their concentrations at the Medley Farm site. Table 7 lists the inorganics and their concentrations for groundwater samples collected from the saprolite wells and Table 8 lists the inorganics and their concentrations for groundwater samples collected from the bedrock wells. Table 9 lists the detection frequencies and the range of concentrations of VOCs found in the saprolite aquifer. Table 10 provides the same degree of information as Table 9 but for VOCs detected in the bedrock aquifer. Those compounds listed in Tables 9 and 10 with an asterisk placed in front of them were identified as chemicals of potential concern.

Figure 13 depicts the contaminants found in each monitoring well completed in the saprolite aquifer and Figure 14 lists the contaminants detected in each bedrock monitoring well. These figures also provide the dates these samples were collected.

Based on data collected during the RI, the horizontal extent of groundwater contamination appears to be limited to portions of the aquifer directly beneath and downgradient of the former disposal areas. VOCs in groundwater are estimated to have traveled 500 to 600 feet in an east-southeasterly direction from the disposal area, in the direction of groundwater flow. Concentrations observed at this distance are detectable, but below established regulatory limits. The highest VOC concentrations detected in the saprolite were found in groundwater immediately beneath the former disposal area with concentrations decreasing with distance from the disposal area. Vertically, VOCs have also migrated into the bedrock zone of the underlying aquifer. Within the confines of the former disposal area, groundwater contamination extends from a depth of approximately 60 feet to a depth of approximately 120 feet from land surface. Two deep bedrock wells (BW-111 and BW-112) installed at the Site encountered competent bedrock beginning at depths of approximately 160-170 feet beneath the Site; consequently, these two deep wells are dry and therefore could not be sampled.

TABLE 6
MEDLEY FARM SITE RI - ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS DETECTED ABOVE QUANTITATION LIMITS
IN GROUND WATER (ug/l), PHASE IA, PHASE IB, AND PHASE II (See Notes)

SAMPLE LOCATION	BW1		SW1	BW2			SW3
SAMPLE I.D.	*BW1-3	BW1-4	SW1-4	BW2-1	BW2-2	BW2-3	SW3-1
SAMPLE DATE	09-28-90	11-27-90	11-27-90	08-09-89	01-10-90	09-28-90	08-08-89
PHASE	PHASE II	PHASE II (Resample)	PHASE II (Resample)	PHASE IA	PHASE IB	PHASE II	PHASE IA
PARAMETER							
Acetone	19		5 BJ			18	
Benzene							
Carbon tetrachloride							
Chloroform					10		
Chloromethane							
Methylene chloride		4 BJ	3 BJ	110 D			
Tetrachloroethene				35 D	18	8	190
Toluene							
Trichloroethene				720 D	530 D	140	140
1,1,2,2-Tetrachloroethane							
1,1,1-Trichloroethane				310 D	270 D	110	
1,1,2-Trichloroethane							
1,1-Dichloroethene				440 D	340 D	130	8
1,2-Dichloroethene (total)							9
1,1-Dichloroethane							
1,2-Dichloroethane				290 D	260 D	120	
2-Butanone							
2-Hexanone							

Notes:

1) No volatile organic compounds were detected above quantitation limits in samples BW4-1, SW1-1, BW1-1, BW3-1, BW4-2, BW110-3, SW106-1, SW102-3, SW104-3, and SW109-3. Compounds identified as common laboratory contaminants in EPA guidance were considered to be present in a sample only if the reported concentration was greater than 10 times the concentration reported in any laboratory blank (see Section 5.10.2 for discussion of data validation) in accordance with EPA guidance.

D - Sample diluted for this analyte.

E - Estimated result. Analyte concentration exceeded the instrument calibration range.

B - Analyte detected in the associated blank. Result not corrected.

J - Estimated result. Analyte detected at less than the sample quantitation limit. Constituents detected at less than quantitation limits are reported only for analytical results of BW1-4, SW1-4, BW4-4, and SW106-4 for comparison to initial Phase II results at these locations.

* Raw data results for BW1-3, SW1-2, BW4-3 and SW106-3 were inconsistent with concentrations previously reported. These wells were subsequently resampled (Nov. 26 and 27, 1990) and samples were submitted to Ecotek Laboratory for analysis. The Ecotek results are indicated by the 'Resample' designation.

TABLE 6 (continued)
MEDLEY FARM SITE RI - ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS DETECTED ABOVE QUANTITATION LIMITS
IN GROUND WATER (ug/l), PHASE IA, PHASE IB, AND PHASE II (See Notes)

SAMPLE LOCATION	SW3		BW4		SW4		
SAMPLE I.D.	SW3-2	SW3-3	*BW4-3	BW4-4	SW4-1	SW4-2	SW4-3
SAMPLE DATE	01-09-90	09-25-90	09-26-90	11-26-90	08-08-89	01-09-90	09-25-90
PHASE	PHASE IB	PHASE II	PHASE II	PHASE II (Resample)	PHASE IA	PHASE IB	PHASE II
PARAMETER							
Acetone							
Benzene							
Carbon tetrachloride			130				
Chloroform			74				
Chloromethane		15					
Methylene chloride				4 BJ			
Tetrachloroethene	200	190					
Toluene			9.5				
Trichloroethene	130	190	49				
1,1,2,2-Tetrachloroethane			19				
1,1,1-Trichloroethane		5.6			3400 D	2800 E	2500 D
1,1,2-Trichloroethane			18		8	13	
1,1-Dichloroethene					1800 D	2100 E	2200 D
1,2-Dichloroethene (total)		5.4				31	
1,1-Dichloroethane					120	38	
1,2-Dichloroethane			13				
2-Butanone							
2-Hexanone							

Notes:

1) No volatile organic compounds were detected above quantitation limits in samples BW4-1, SW1-1, BW1-1, BW3-1, BW4-2, BW110-3, SW106-1, SW102-3, SW104-3, and SW109-3. Compounds identified as common laboratory contaminants in EPA guidance were considered to be present in a sample only if the reported concentration was greater than 10 times the concentration reported in any laboratory blank (see Section 5.10.2 for discussion of data validation) in accordance with EPA guidance.

D - Sample diluted for this analyte.

E - Estimated result. Analyte concentration exceeded the instrument calibration range.

B - Analyte detected in the associated blank. Result not corrected.

J - Estimated result. Analyte detected at less than the sample quantitation limit. Constituents detected at les than quantitation limits are reported only for analytical results of BW1-4, SW1-4, BW4-4, and SW106-4 for comparison to initial Phase II results at these locations.

* Raw data results for BW1-3, SW1-2, BW4-3 and SW106-3 were inconsistent with concentrations previously reported. These wells were subsequently resampled (Nov. 26 and 27, 1990) and samples were submitted to Ecotek Laboratory for analysis. The Ecotek results are indicated by the 'Resample' designation.

TABLE 6 (continued)
MEDLEY FARM SITE RI - ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS DETECTED ABOVE QUANTITATION LIMITS
IN GROUND WATER (ug/l), PHASE IA, PHASE IB, AND PHASE II (See Notes)

SAMPLE LOCATION	SW101	BW105			BW106	SW106	
SAMPLE I.D.	SW101-3	BW105-1X	BW105-1Z	BW105-3	BW106-1	*SW106-3	SW106-4
SAMPLE DATE	09-26-90	09-19-90	09-18-90	10-15-90	09-28-90	09-27-90	11-26-90
PHASE	PHASE II	PHASE II	PHASE II	PHASE II	PHASE II	PHASE II	PHASE II (Resample)
PARAMETER							
Acetone						160	5 BJ
Benzene		95		11			
Carbon tetrachloride							
Chloroform							
Chloromethane		110					
Methylene chloride							4 BJ
Tetrachloroethene							5
Toluene						91	
Trichloroethene							6
1,1,2,2-Tetrachloroethane							
1,1,1-Trichloroethane	7	90	80	9	5.2	9.3	
1,1,2-Trichloroethane							
1,1-Dichloroethene		27	39				2 J
1,2-Dichloroethene (total)							
1,1-Dichloroethane							
1,2-Dichloroethane							
2-Butanone					13	170	
2-Hexanone						14	

Notes:

1) No volatile organic compounds were detected above quantitation limits in samples BW4-1, SW1-1, BW1-1, BW3-1, BW4-2, BW110-3, SW106-1, SW102-3, SW104-3, and SW109-3. Compounds identified as common laboratory contaminants in EPA guidance were considered to be present in a sample only if the reported concentration was greater than 10 times the concentration reported in any laboratory blank (see Section 5.10.2 for discussion of data validation) in accordance with EPA guidance.

D - Sample diluted for this analyte.

E - Estimated result. Analyte concentration exceeded the instrument calibration range.

B - Analyte detected in the associated blank. Result not corrected.

J - Estimated result. Analyte detected at less than the sample quantitation limit. Constituents detected at les than quantitation limits are reported only for analytical results of BW1-4, SW1-4, BW4-4, and SW106-4 for comparison to initial Phase II results at these locations.

* Raw data results for BW1-3, SW1-2, BW4-3 and SW106-3 were inconsistent with concentrations previously reported. These wells were subsequently resampled (Nov. 26 and 27, 1990) and samples were submitted to Ecotek Laboratory for analysis. The Ecotek results are indicated by the 'Resample' designation.

TABLE 6 (continued)
MEDLEY FARM SITE RI - ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS DETECTED ABOVE QUANTITATION LIMITS
IN GROUND WATER (ug/l), PHASE IA, PHASE IB, AND PHASE II (See Notes)

SAMPLE LOCATION	BW108	SW108	BW109
SAMPLE I.D.	BW108-3	SW108-3	BW109-3
SAMPLE DATE	10-02-90	09-25-90	10-15-90
PARAMETER			
Acetone			
Benzene			
Carbon tetrachloride			
Chloroform			6
Chloromethane		26	
Methylene chloride			
Tetrachloroethene	230	30	
Toluene			
Trichloroethene	380	45	
1,1,2,2-Tetrachloroethane			
1,1,1-Trichloroethane	15	13	6
1,1,2-Trichloroethane			
1,1-Dichloroethene	80	11	
1,2-Dichloroethene (total)	17		
1,1-Dichloroethane			
1,2-Dichloroethane	12		
2-Butanone			
2-Hexanone			

Notes:

1) No volatile organic compounds were detected above quantitation limits in samples BW4-1, SW1-1, BW3-1, BW4-2, BW110-3, SW106-1, SW102-3, SW104-3, and SW109-3. Compounds identified as commo laboratory contaminants in EPA guidance were considered to be present in a sample only if the reported concentration was greater than 10 times the concentration reported in any laboratory blank (see Section 5.10.2 for discussion of data validation) in accordance with EPA guidance.

D - Sample diluted for this analyte.

E - Estimated result. Analyte concentration exceeded the instrument calibration range.

B - Analyte detected in the associated blank. Result not corrected.

J - Estimated result. Analyte detected at less than the sample quantitation limit. Constituents detected at than quantitation limits are reported only for analytical results of BW1-4, SW1-4, BW4-4, and SW106-4 for comparison to initial Phase II results at these locations.

* Raw data results for BW1-3, SW1-2, BW4-3 and SW106-3 were inconsistent with concentrations previously reported. These wells were subsequently resampled (Nov. 26 and 27, 1990) and samples were submitted to Ecotek Laboratory for analysis. The Ecotek results are indicated by the 'Resample' designation.

5 9 0054

TABLE 7
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
METALS DETECTED
IN
GROUND WATER (ug/l) - See Notes
SAPROLITE WELLS

					EPA Drinking Water Regulations	
SAMPLE LOCATION	SW1		SW3	SW4	Promulgated	Proposed
SAMPLE I.D.	SW1-01	SW1-02	SW3-01	SW4-01	MCLs (ug/l)	MCLs (ug/l)
PARAMETER						
Aluminum, total	189000	12900	11800	41400	*	*
Aluminum, dissolved						
Antimony, total	492	BDL (c)	BDL (c)	BDL (c)	*	10.5 (g)
Antimony, dissolved						
Arsenic, total	65.6	BDL (b)	BDL (c)	BDL (c)	50 (d)	*
Arsenic, dissolved						
Barium, total	1690	BDL (b)	BDL (b)	592	1000 (d)	2000 (h)
Barium, dissolved						
Beryllium, total	14.2	BDL (c)	BDL (b)	6	*	1 (g)
Beryllium, dissolved						
Cadmium, total	7	BDL (c)	BDL (c)	BDL (c)	5 (d)	*
Cadmium, dissolved						
Calcium, total	34100	BDL (b)	8490	18500	*	*
Calcium, dissolved						
Chromium, total	97.8	BDL (b)	12.7	20.8	100 (d)	*
Chromium, dissolved						
Cobalt total	183	BDL (b)	BDL (b)	BDL (b)	*	*
Cobalt, dissolved						
Copper, total	307	BDL (b)	45.2	BDL (c)	1000 (e)	1300 (f)
Copper, dissolved						
Iron, total	266000	17900	14600	24.3	300 (e)	*
Iron, dissolved						
Lead, total	45.8	4.8	5.3	24.3	50 (d)	(15) (j)
Lead, dissolved						
Magnesium, total	143000	9390 (a)	6150	24300	*	*
Magnesium, dissolved						
Manganese, total	10700	727	794	3210	50 (e)	*
Manganese, dissolved						
Mercury, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	2 (d)	*
Mercury, dissolved						
Nickel, total	116	BDL (c)	BDL (c)	BDL (b)	*	100 (g)
Nickel, dissolved						
Potassium, total	105000	7690	6180	9100	*	*
Potassium, dissolved						
Selenium, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	50 (i)	*
Selenium, dissolved						
Silver, total	BDL (c)	BDL (c)	20.2	BDL (c)	100(e)	*
Silver dissolved						
Sodium, total	BDL (b)	9730	9930	12600	*	*
Sodium, dissolved						
Thallium, total	BDL (b)	BDL (c)	BDL (c)	BDL (c)	*	2.1 (g)
Thallium, dissolved						
Vanadium, total	305	BDL (b)	BDL (b)	72.3	*	*
Vanadium, dissolved						
Zinc, total	1290	92.5	19 (a)	884 (a)	5000 (e)	*
Zinc dissolved						

Notes
(a) Estimated result.
(b) Below contract required detection limit.
(c) Below instrument detection limit.
(d) Primary Maximum Contaminant Level (MCL)
(e) Secondary MCL for public water systems
(f) Federal Register, August 18, 1988
(g) Federal Register, July 25, 1989
(h) Federal Register, January 30, 1991
(i) Federal Register, January 30, 1991 (effective date July 30, 1992)
(j) Superfund cleanup level

TABLE 8
MEDLEY FARM SITE RI
ANALYTICAL DATA SUMMARY
METALS DETECTED
IN
GROUND WATER (ug/l) - See Notes
BEDROCK WELLS

5 9 0055

					EPA Drinking Water Regulations	
SAMPLE LOCATION	BW1		BW2	BW4	Promulgated	Proposed
SAMPLE I.D.	BW1-1	BW1-3	BW2-1	BW4-1	MCLs (ug/l)	MCLs (ug/l)
PARAMETER						
Aluminum, total	1730	395	500	5570	*	*
Aluminum, dissolved		BDL (b)				
Antimony, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	*	10/5 (g)
Antimony, dissolved		BDL (c)				
Arsenic, total	BDL (b)	BDL (c)	BDL (c)	BDL (c)	50 (d)	*
Arsenic, dissolved		12.2				
Barium, total	BDL (b)	BDL (b)	BDL (b)	BDL (b)	1000 (d)	2000 (h)
Barium, dissolved		BDL (b)				
Beryllium, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	*	1 (g)
Beryllium, dissolved		BDL (c)				
Cadmium, total	BDL (c)	BDL (c)	10	BDL (c)	5 (i)	*
Cadmium, dissolved		BDL (c)				
Calcium, total	9690	6990	7300	32200	*	*
Calcium, dissolved		6770				
Chromium, total	BDL (b)	BDL (c)	BDL (c)	BDL (b)	100 (i)	*
Chromium, dissolved		BDL (b)				
Cobalt, total	BDL (b)	BDL (c)	BDL (c)	BDL (b)	*	*
Cobalt, dissolved		BDL (c)				
Copper, total	BDL (b)	BDL (c)	BDL (c)	BDL (c)	1000 (e)	1300 (f)
Copper, dissolved		BDL (b)				
Iron, total	1900	613	870	3410	300 (e)	*
Iron, dissolved		BDL (b)				
Lead, total	5.8	4	BDL (b)	BDL (c)	50 (d)	(15) (j)
Lead, dissolved		BDL (b)				
Magnesium, total	BDL (b)	BDL (b)	BDL (b)	13400	*	*
Magnesium, dissolved		BDL (b)				
Manganese, total	59.7	BDL (b)	33	183	50 (e)	*
Manganese, dissolved		BDL (b)				
Mercury, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	2 (d)	*
Mercury, dissolved		BDL (c)				
Nickel, total	BDL (c)	BDL (c)	BDL (b)	BDL (c)	*	100 (g)
Nickel, dissolved		BDL (c)				
Potassium, total	BDL (b)	BDL (b)	BDL (b)	BDL (c)	*	*
Potassium, dissolved		BDL (b)				
Selenium, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	50 (i)	*
Selenium, dissolved		BDL (c)				
Silver, total	BDL (b)	BDL (c)	BDL (c)	BDL (c)	100 (e)	*
Silver, dissolved		BDL (b)				
Sodium, total	10700	9000	8400	12900	*	*
Sodium, dissolved		9100				
Thallium, total	BDL (c)	BDL (c)	BDL (c)	BDL (c)	*	2/1 (g)
Thallium, dissolved		BDL (c)				
Vanadium, total	BDL (b)	BDL (b)	BDL (c)	BDL (b)	*	*
Vanadium, dissolved		BDL (b)				
Zinc, total	BDL (b)	BDL (b)	110	38.7 (a)	5000 (e)	*
Zinc, dissolved		BDL (b)				

Notes: (a) Estimated result.
(b) Below contract required detection limit.
(c) Below instrument detection limit.
(d) Primary Maximum Contaminant Level (MCL)
(e) Secondary MCL for public water systems
(f) Federal Register, August 18, 1988
(g) Federal Register, July 25, 1990
(h) Federal Register, January 30, 1991
(i) Federal Register, January 30, 1991 (effective date July 30, 1992)
(j) Superfund cleanup level

TABLE 9

CHEMICALS DETECTED IN GROUND WATER - SAPROLITE WELLS
MEDLEY FARM SITE

Chemical	Frequency of Detection	Contract Required Quantitation Limit (ug/l)	Range of Detected Concentrations (ug/l)[a]
Volatile Organic Compounds			
*1,1-Dichloroethene	6/14	5	1.1-2200
*1,1-Dichloroethane	2/14	5	38-120
*1,1,1-Trichloroethane	9/14	5	1.5-3400
*1,1,2-Trichloroethane	2/14	5	8-13
*1,2-Dichloroethene (total)	3/14	5	5.4-31
Acetone	1/14	10	7
Benzene	1/14	5	0.7
Bromomethane	3/14	10	1.9-3
Carbon Disulfide	1/14	5	3
Chlorobenzene	1/14	5	0.9
Chloroform	2/14	5	3-4
*Chloromethane	3/14	10	5.5-26
*Methylene Chloride	3/14	5	2.1-38
*Tetrachloroethene	5/14	5	2-200
Toluene	2/14	5	1-1.5
*Trichloroethene	5/14	5	6-190
Semi-Volatile Organic Compounds			
1,2,4-Trichlorobenzene	1/2	10	3

* Chemical of potential concern

[a] Detected concentrations include estimated results (chemical concentrations less than the contract-required quantitation limit).

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TABLE 10

CHEMICALS DETECTED IN GROUND WATER - BEDROCK WELLS
MEDLEY FARM SITE

Chemical	Frequency of Detection	Contract Required Quantitation Limit (ug/l)	Range of Detected Concentrations (ug/l)[a]
Volatile Organic Compounds			
*1,1-Dichloroethene	6/15	5	2.2-440
1,1-Dichloroethane	2/15	5	2-3
*1,1,1-Trichloroethane	9/15	5	4-310
1,1,2-Trichloroethane	1/15	5	3
*1,2-Dichloroethane	5/15	5	12-290
*1,2-Dichloroethene (total)	2/15	5	2-17
*2-Butanone	4/15	10	6.8-13
*Acetone	3/15	10	1-18
*Benzene	1/15	5	11
Carbon Disulfide	1/15	5	4
Chlorobenzene	1/15	5	1
*Chloroform	6/15	5	4-7
Chloromethane	1/15	10	2
*Methylene Chloride	3/15	5	48-110
*Tetrachloroethene	5/15	5	8-230
Toluene[b]	2/15	5	3-5
*Trichloroethene	5/15	5	140-720
Semi-Volatile Organic Compounds			
None detected			

* Chemical of potential concern

[a] Detected concentrations include estimated results (chemical concentrations less than the contract-required quantitation limit).
[b] Detected concentrations of 5 ug/l is for a diluted sample with a Sample Quantitation Limit of 25 ug/l.

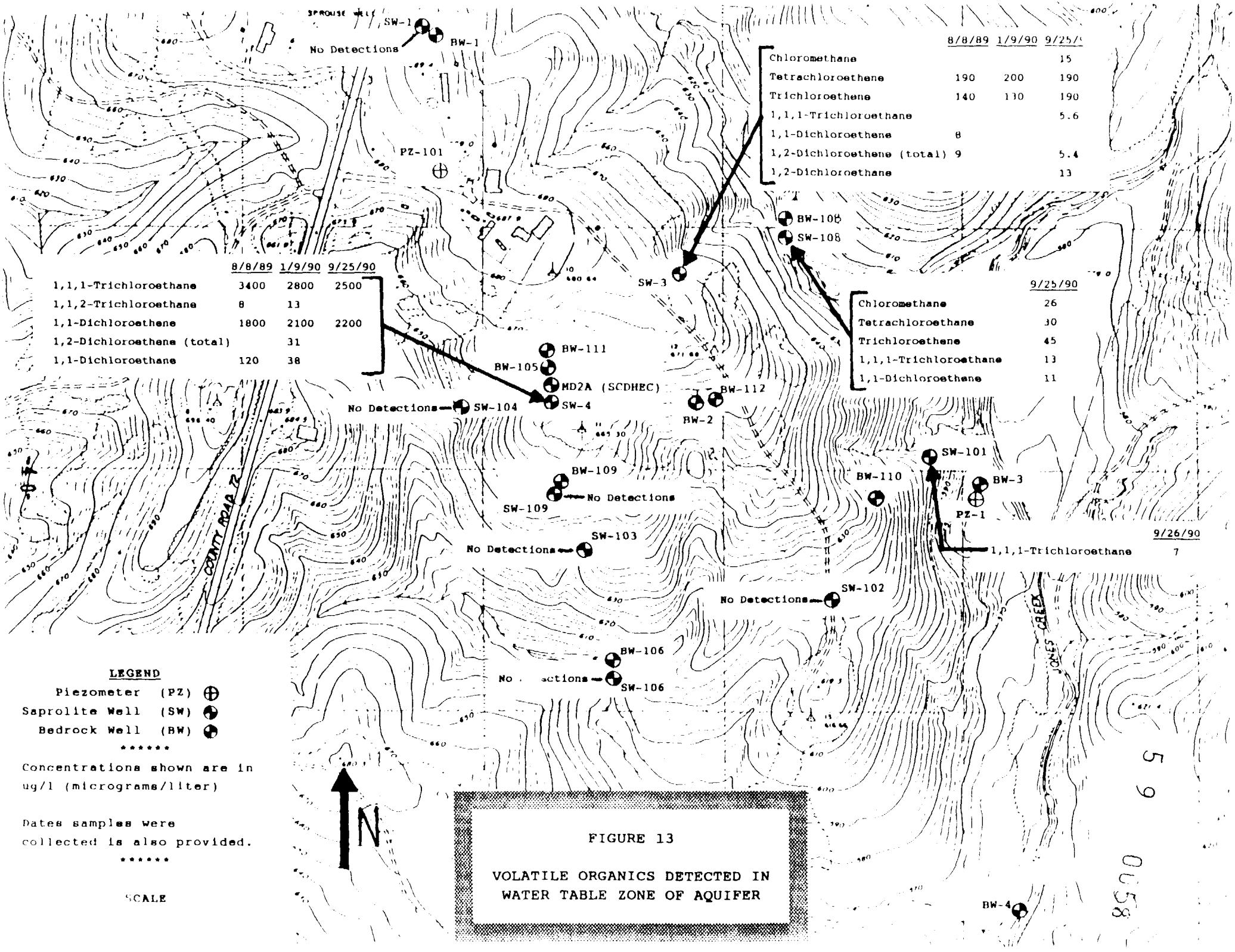


FIGURE 13

VOLATILE ORGANICS DETECTED IN WATER TABLE ZONE OF AQUIFER

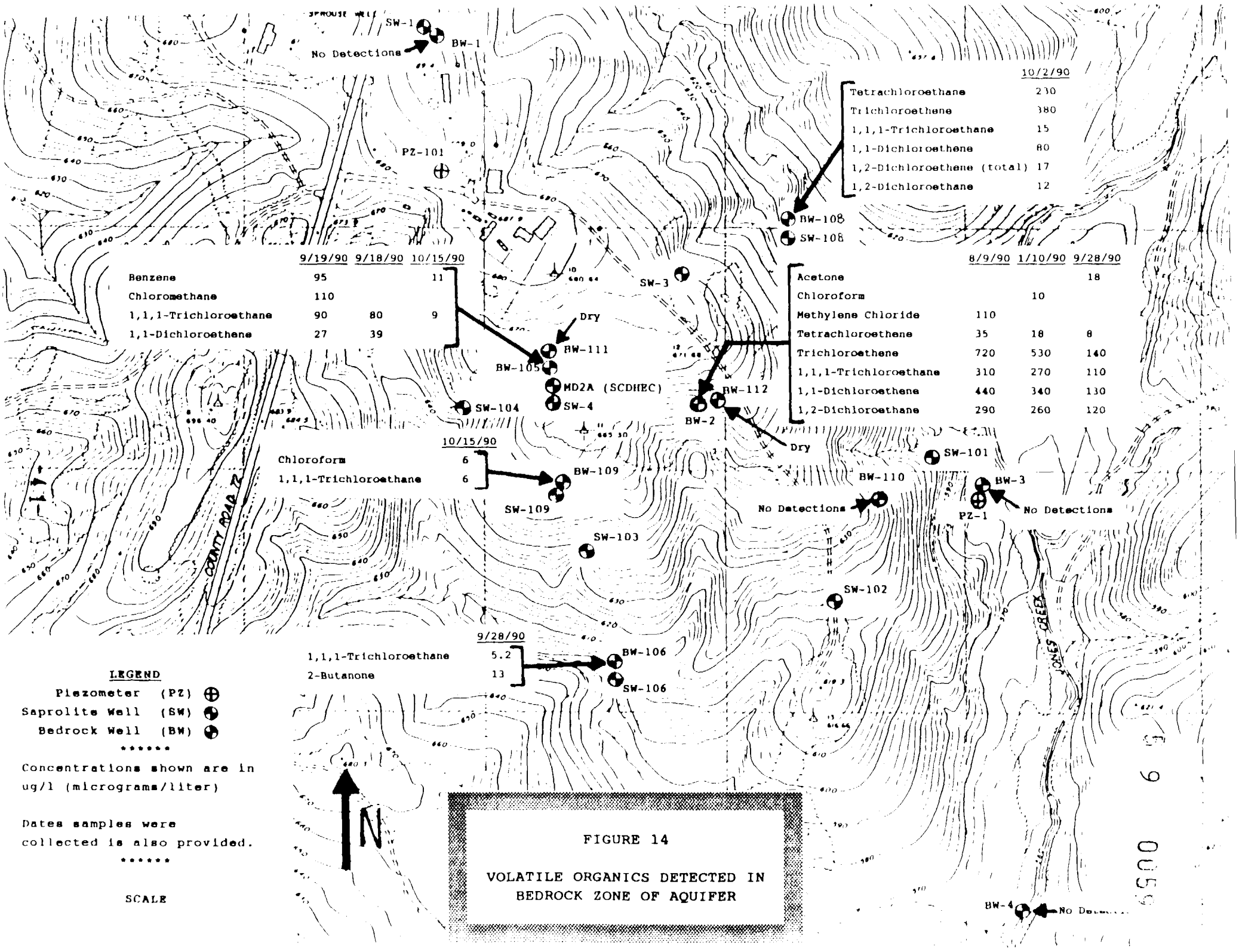


FIGURE 14

VOLATILE ORGANICS DETECTED IN BEDROCK ZONE OF AQUIFER

The presence of VOCs in both portions of the aquifer, the saprolite and bedrock, is consistent with the interrelated nature of these two water-bearing zones. The concentrations of VOCs decrease with depth. Based on the observed distribution of VOCs, the primary path of contaminant migration in groundwater is through the saprolite and the bedrock transition zone into the fractured bedrock.

7.4 STREAM SEDIMENT/SURFACE WATER

No contaminants were detected in the surface water samples, the sediment samples, or the monitoring wells closest to Jones Creek. However, based on analytical data for samples collected from monitoring wells SW-108, BW-108, and BW-106, groundwater contaminated with VOCs may be entering tributaries to Jones Creek. Even if this is the case, any VOCs discharging into either of these tributaries along with the groundwater, are volatilizing from the water column prior to commingling with the waters in Jones Creek. This is verified by the analytical data for surface water and sediment samples collected from Jones Creek. The locations of the surface water/sediment sampling points can be found in Figure 15.

7.5 HYDROGEOLOGICAL SETTING

Residual soil at the Site is absent or occurs as a thin layer overlying the saprolite. This soil layer ranges in thickness from zero to 11 feet and typically consists of clayey silt with varying amounts of fine sand, clay, mica flakes, and quartz gravel. In some areas, thin layers of clayey silt/silty clay fill were encountered. The fill was probably placed on-site during the 1983 immediate removal action and Site clean-up. The fill is not significant in terms of overall Site geology.

The saprolite is relatively thick across the Site, ranging from 50 to 70 feet near the former disposal areas to 7 to 28 feet along Jones Creek at the eastern boundary of the property. The lithologic characteristics of the saprolite are similar to the residual soils and are relatively consistent both vertically and horizontally. Saprolite observed in borings drilled at the Site consists predominantly of a silt with varying amounts of fine to coarse sand, clay, mica flakes, and quartz gravel. The predominant relict (texture) and foliation indicate parent rocks of metasiltstone, gneiss, and mica schist, though in several instances, the parent rock was not identifiable.

The bedrock was investigated by continuous coring at numerous locations. The bedrock consists primarily of a gneiss that varies from a schistose gneiss to a quartzo-feldspathic and quartz-amphibole gneiss. The bedrock is predominantly hard, slightly weathered to fresh, gray, and fine to medium-grained, with closely to moderately closely (0.5 to 2.5 feet) spaced joints. The joints tend to be smooth to rough and moderately dipping (35 to 55 degrees). Foliation of the bedrock is moderately dipping (35 to 55 degrees) to steep (55 to 85 degrees).

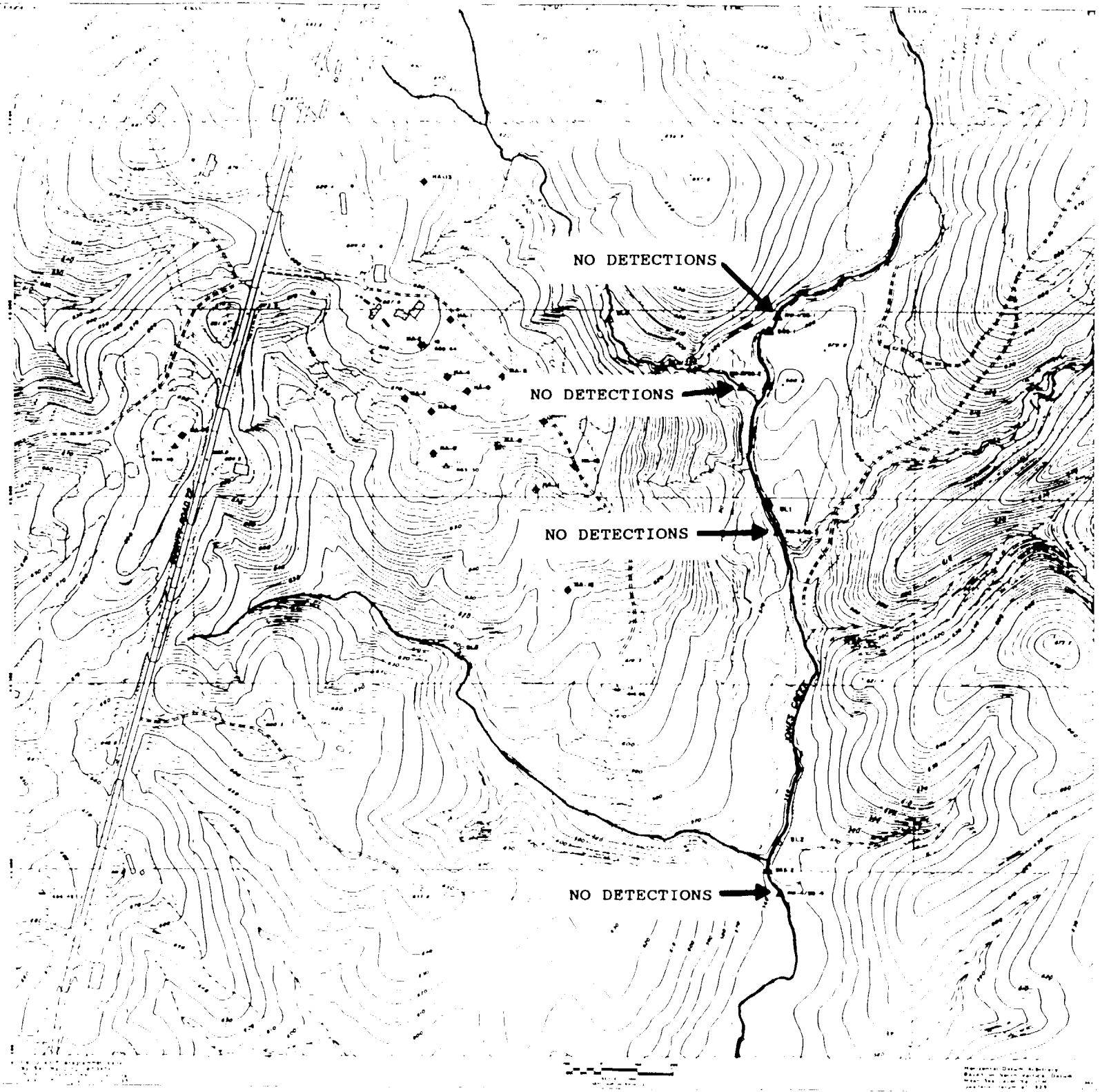


FIGURE 15

LOCATIONS OF SURFACE WATER/ SEDIMENT SAMPLES

Auger refusal was encountered at depths ranging from approximately 70 to 100 feet within the former disposal area. The overburden thickness decreases outward toward the boundaries of the Medley property, to a minimum of approximately 20 feet adjacent to Jones Creek. Evidence of groundwater movement through the bedrock was observed in the form of iron oxide staining along joint surfaces.

Groundwater at the Medley Farm site occurs in the saprolite, in the zone of highly fractured and weathered bedrock zone (identified as the transition zone), and in moderately fractured bedrock underlying the Site. Depth to groundwater at the Site is on the order of 56 to 68 feet in the disposal area, decreasing to six to eight feet adjacent to Jones Creek.

Subsurface conditions encountered at the Site are depicted in several cross sections of the Medley property. Figure 16 provides the orientation of the cross sectional views A-A', B-B', and C-C'. Figure 17, Figure 18, and Figure 19 show each cross sectional view, respectively.

In general, an aquifer system consisting of flow through both porous and fractured media exists in the Piedmont Province and at the Medley Farm site. The water table generally occurs in the saprolite across most of the Medley Farm property, with the saprolite serving as a porous medium for groundwater flow. In the vicinity of BW-2 at the eastern edge of the former disposal area, the water table occurs in the bedrock transition zone. Although the groundwater occuring in the saprolite and bedrock is part of an interconnected aquifer system, the groundwater in the bedrock at the Site is under semi-confined to confined conditions, with the exception of the BW-2 vicinity where the water table occurs in the bedrock.

The shallow saprolite has a higher porosity than the bedrock, but due to the low hydraulic conductivity, the saprolite acts mainly as a storage and recharge source for the bedrock. Yields from wells completed in the saprolite are generally very low. Yields from bedrock wells are relatively high, but depend on the nature, quantity, and interconnection of the secondary (fracture) porosity the well encounters. The bedrock wells completed in the moderately fractured bedrock at the Site demonstrate relatively high yields (5-7 gpm). Groundwater in the saprolite wells, however, can be completely evacuated with a bailer requiring several hours for complete recovery of the well.

Groundwater flow in the water-table aquifer at the Medley Farm site is primarily to the southeast towards Jones Creek, as shown in Figure 20. The hydraulic gradient changes slightly across the Site, ranging from 0.056 beneath the former disposal area to 0.046 further downgradient. The primary direction of groundwater flow in the bedrock aquifer is also to the southeast, as shown in Figure 21, with an average hydraulic gradient of 0.042. The calculated horizontal groundwater flow velocities are estimated to range from 1.05 feet/day (384 feet/year) to 1.28 feet/day (486 feet/year) for the saprolite and 0.31 feet/day (81 feet/year) for groundwater in the bedrock.

FIGURE 16

CROSS SECTIONS
LOCATION MAP

Medley Farm Site
Gaffney, South Carolina

Remedial Investigation/
Feasibility Study

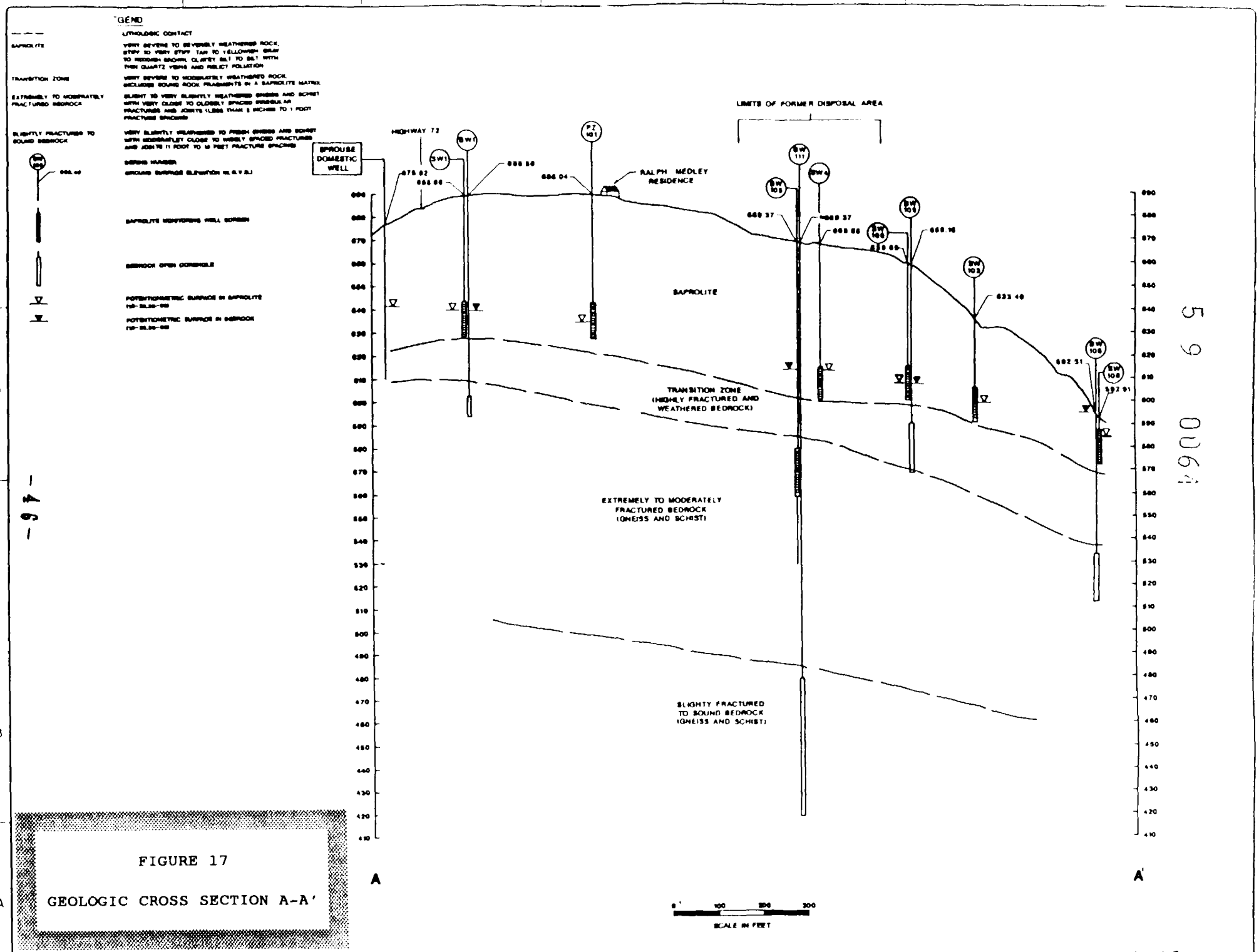


FIGURE 17

GEOLOGIC CROSS SECTION A-A'

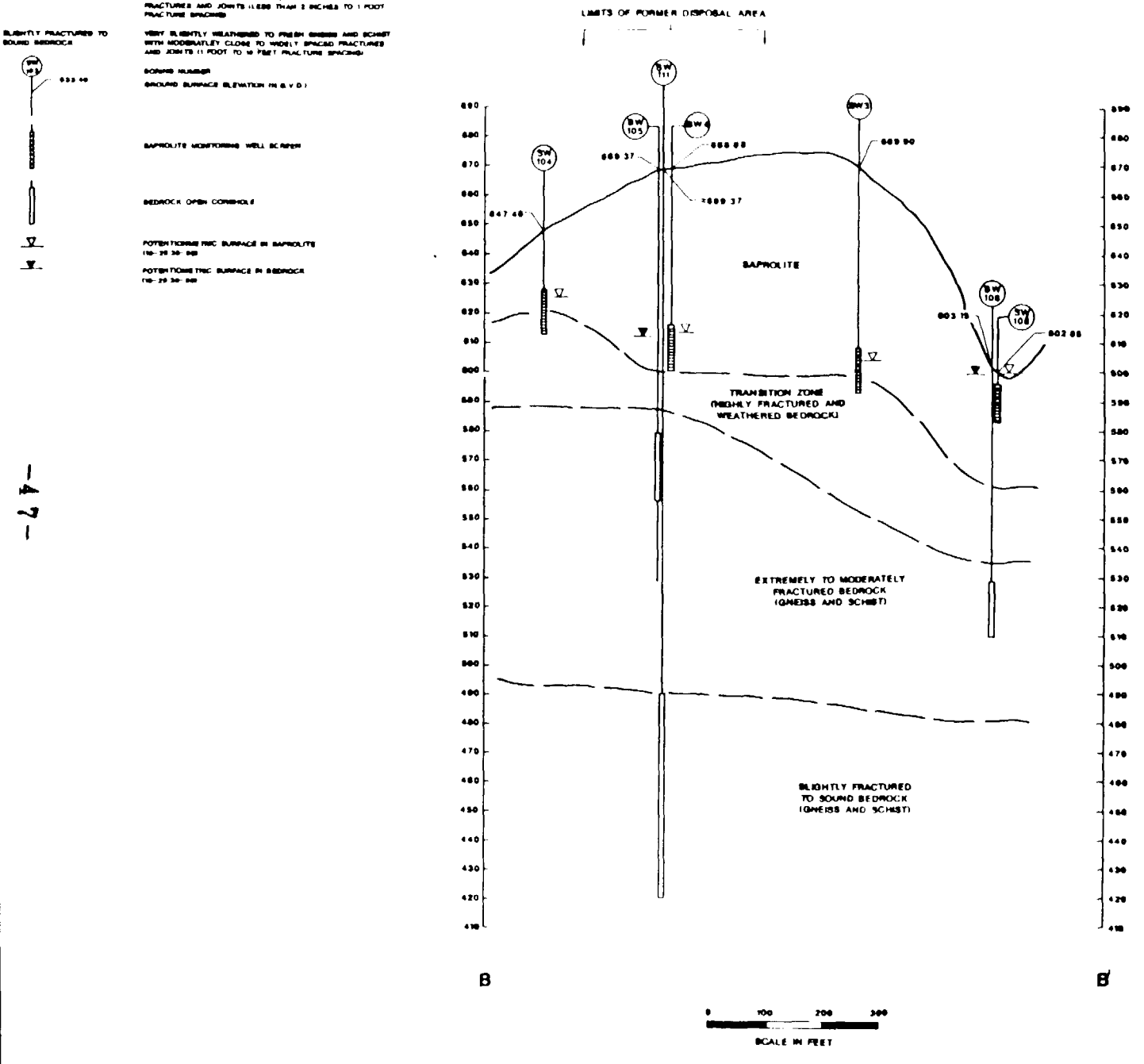
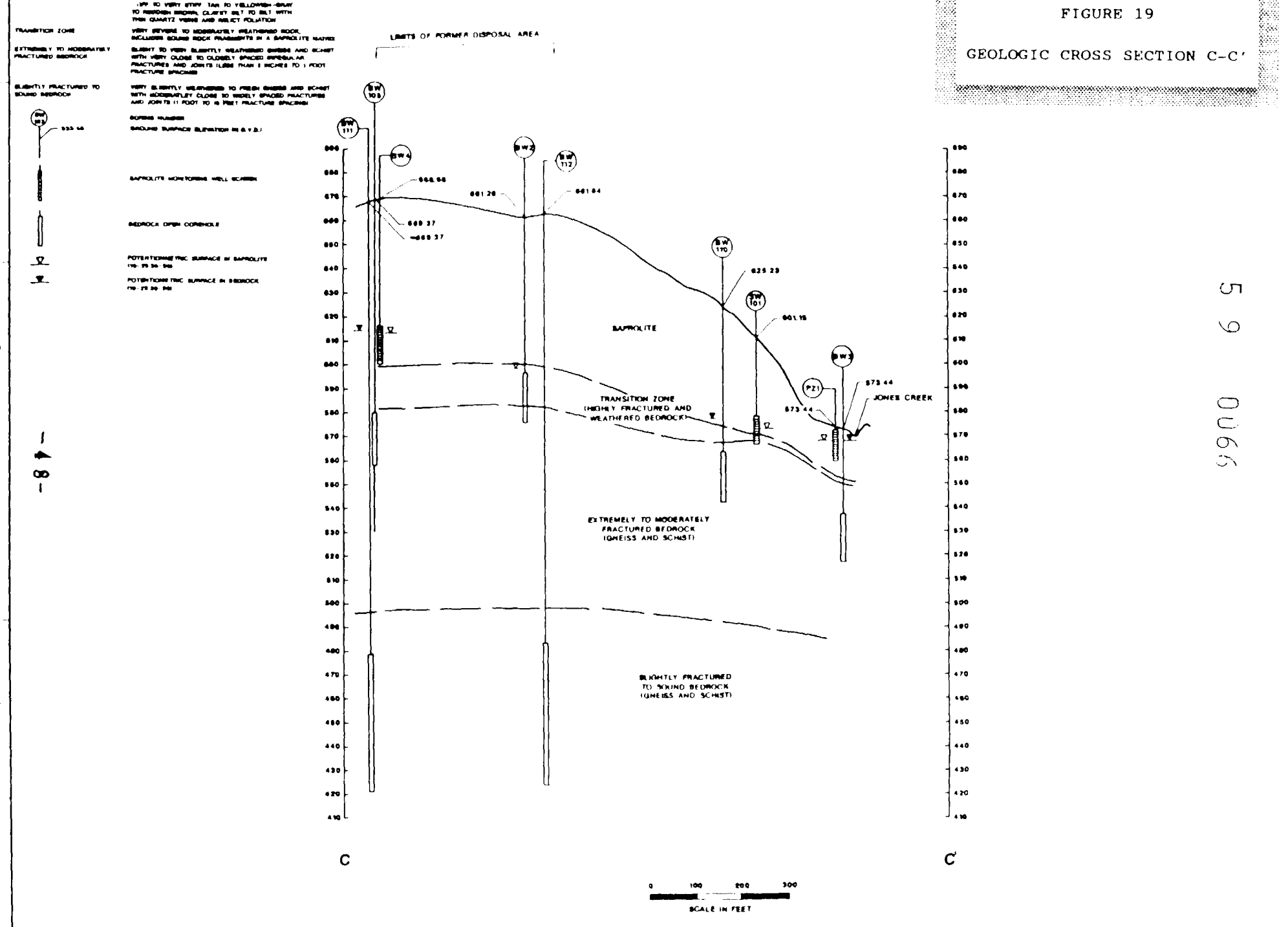


FIGURE 18

GEOLOGIC CROSS SECTION B-B'

FIGURE 19

GEOLOGIC CROSS SECTION C-C'



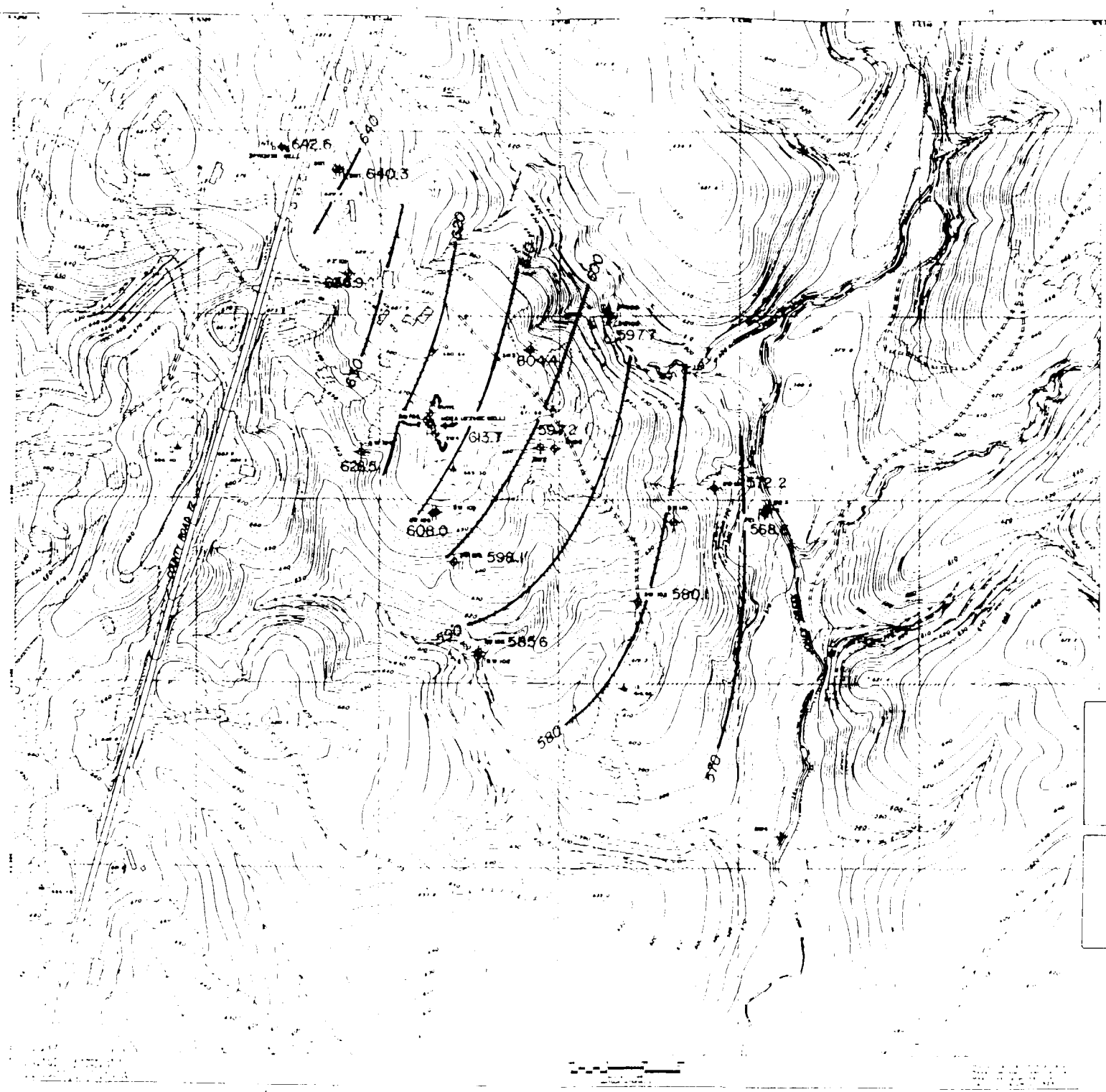


FIGURE 20

WATER TABLE

POTENTIOMETRIC SURFACE

10/29 & 10/30/1990

Medley Farm Site

Gaffney, South Carolina

Remedial Investigation

Phase IV Study

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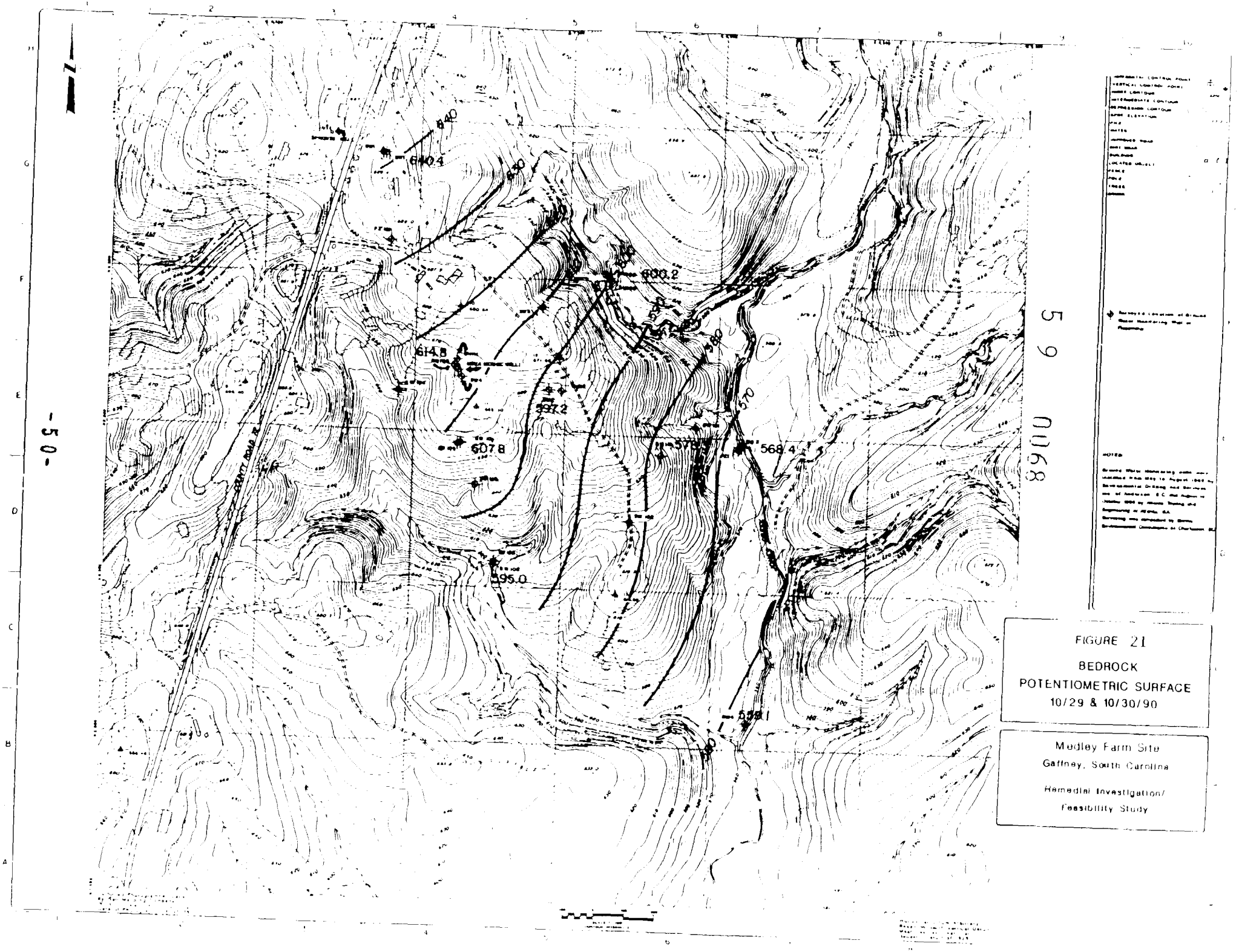

640.4
614.8
607.8
595.0
600.2
568.4
FIGURE 21
BEDROCK
POTENTIOMETRIC SURFACE
10/29 & 10/30/90
Medley Farm Site
Gaffney, South Carolina
Remedial Investigation/
Feasibility Study

The hydraulic data collected during the RI also showed that the Sprouse well is located hydraulically upgradient of the Site. This was a concern as methylene chloride was detected in samples collected by SCDHEC from the Sprouse well in June 1983 and July 1984. At that time, this contamination was suspected to be Site related. The findings of the RI confirmed that this contamination did not originate from the Medley Farm Superfund site.

Water level measurements made in six saprolite/bedrock well clusters indicate upward vertical hydraulic gradients of varying magnitude across most of the Site. Upward vertical gradients were observed at four monitoring locations (BW-1/SW-1, BW-105/SW-4, BW-106/SW-106, and BW-108/SW-108). Downward vertical gradients were observed at only two locations (BW-3/PZ1 and BW-109/SW-109) monitored during October 1990. The presence of upward vertical gradients indicate vertical migration of contaminants from the Site. The presence of upward vertical gradients reduces the potential for contaminants to move downward in the aquifer.

Jones Creek and its tributaries serve as zones of groundwater discharge from the Medley Farm site. Base flow in Jones Creek at the Site is 200 gpm. Water levels in the saprolite and bedrock adjacent to Jones Creek (PZ-1 and BW-3) are consistently above water levels observed in Jones Creek at staff gauge SL-1. Similarly, water levels in the saprolite and bedrock at SW-108 and BW-108 are greater than water levels observed in the tributary at staff gauge SL-3. The water level in BW-106 is greater than the water level observed in the tributary at staff gauge SL-5. However, the water level in SW-106 is less than the water level observed at staff gauge SL-5, indicating localized surface water recharge to the saprolite aquifer at this location. Refer to Figure 15 for the staff gauge locations.

8.0 SUMMARY OF SITE RISKS

Based upon reasonable maximum exposures to residual chemicals at the Medley Farm Site, the risk assessment showed that there is neither significant carcinogenic nor non-carcinogenic risk to either human health or the environment under present day, baseline conditions. The cumulative carcinogenic human health risk at the Site is estimated to be 8.6×10^{-7}. This baseline risk is acceptable as this risk is below the 1×10^{-6} level and the EPA remediation level goals of 10^{-4} to 10^{-6} for Site remediation. This risk level of 8.6×10^{-7} is attributable to Site soils as there are no groundwater receptors on the Site or downgradient near the property boundary.

The potential for non-carcinogenic human health effects under present day conditions (hazard index = 2.9×10^{-4}) is below the EPA hazard quotient of one. A value above one would indicate a potential for adverse effects. This hazard index of 2.9×10^{-4} is also attributable to only soils as there are no present groundwater receptors on or near the Site.

A future use risk scenario was also developed for the Medley Farm site. The future risk scenario assumed residential development of the Site including the installation of potable wells and therefore, consumption of groundwater at the Site would occur. Under this future use scenario, the total risk becomes 1.1×10^{-2} which is greater than the acceptable risk range of 10^{-4} to 10^{-6}. The hazard index under the future residential use scenario becomes 5.6 which is above unity. This future risk is the basis for the remedial action specified in this ROD.

No potential for significant risk to wildlife on the property is expected to occur under present day conditions or under the future residential use scenario.

8.1 CONTAMINANTS OF CONCERN

Table 11 provides a comprehensive list of the contaminants identified as chemicals of potential concern. A contaminant was included in Table 11 if it was detected at or above the CRQL at least once in a given environmental media. Of the 23 chemicals detected at the Site, 17 were identified as chemicals of potential concern. Tables 12 and 13 provide the exposure point concentrations that were used in the risk calculations.

The primary chemical residuals observed in surface soils at the Site are VOCs, which were detected above the CRQL in ten of the surface soil samples. SVOCs were not as widely distributed. They were detected above the CRQL in three samples and below the CRQL in two other samples. PCB-1254 was only detected in three samples and toxaphene in one, in each instance above the CRQL. The extent of site-related chemicals in surface soil is essentially limited to the former disposal area.

Elevated concentrations of VOCs were detected in groundwater samples from 12 of the monitoring wells at the Site; SVOCs, pesticides, and PCBs were not detected above the CRQL. The horizontal extent of site-related chemicals in groundwater appear limited to the former disposal area and immediately downgradient. Vertically, VOCs have been confirmed in both the saprolite and bedrock portions of the aquifer.

8.2 EXPOSURE ASSESSMENT

The populations that potentially may be exposed to site-related chemicals are residents living in the area surrounding the Medley property and trespassers who may enter the property, including hunters and children. The closest potentially exposed individuals consist of the property owners, who live on the Medley property, approximately 100 feet west of the Site. Approximately 300 people live within a one-mile radius.

A complete exposure pathway includes a chemical source/release, retention or transport medium, exposure point, and route of exposure. Two potential human exposure pathways were identified: (1) exposure to site-related chemicals in the groundwater; and (2) exposure to Site soil.

 TABLE 11

CHEMICALS OF POTENTIAL CONCERN BY MEDIUM
MEDLEY FARM SITE

	Surface Soil	Ground Water (Saprolite)	Ground Water (Bedrock)
Volatile Organic Compounds			
1,1-Dichloroethene		X	X
1,1-Dichloroethane		X	
1,1,1-Trichloroethane		X	X
1,1,2-Trichloroethane	X	X	
1,1,2,2-Tetrachloroethane	X		
1,2-Dichloroethane			X
1,2-Dichloroethene (total)	X	X	
1,2-Dichloropropane	X		
2-Butanone			X
Acetone			X
Benzene			X
Chloroform			X
Chloromethane		X	
Ethylbenzene	X		
Methylene Chloride	X	X	X
Styrene	X		
Tetrachloroethene	X	X	X
Trichloroethene	X	X	X
Vinyl Chloride	X		
Semi-Volatile Organic Compounds			
1,2,4-Trichlorobenzene	X		
Butylbenzylphthalate	X		
Di-n-butylphthalate	X		
Di-n-octylphthalate	X		
bis(2-Ethylhexyl)phthalate	X		
Pesticides/PCB			
Toxaphene	X		
PCB-1254	X		

X = Chemical detected in that medium

TABLE 12

EXPOSURE POINT CONCENTRATIONS - SURFACE SOIL
MEDLEY FARM SITE

Chemical	Concentration (µg/kg)
1,1,2-Trichloroethane	53.7
1,1,2,2-Tetrachloroethane	35.2
1,2-Dichloroethene (Total)	84.1
1,2-Dichloropropane	7.1
Ethylbenzene	10.3
Methylene Chloride	8.4
Styrene	4.6
Tetrachloroethene	28.3
Trichloroethene	25.8
Vinyl Chloride	59.8
1,2,4-Trichlorobenzene	557.9
Butylbenzylphthalate	486.1
Di-n-butylphthalate	397.5
Di-n-octylphthalate	1,696.8
bis (2-Ethylhexyl)phthalate	10,001.1
Toxaphene	164.8
PCB-1254	512.6

Concentrations are the 95 percent upper confidence limit on the arithmetic average of measured concentrations in onsite surface soils.

TABLE 13

EXPOSURE POINT CONCENTRATIONS - GROUND WATER
MEDLEY FARM SITE

Chemical	Concentration (µg/liter)
1,1-Dichloroethene	1490.60
1,1-Dichloroethane	37.16
1,1,1-Trichloroethane	1636.35
1,1,2-Trichloroethane	5.96
1,2-Dichloroethane	113.66
1,2-Dichloroethene (total)	10.85
Acetone	8.36
Benzene	4.68
2-Butanone	5.79
Chloromethane	7.55
Methylene Chloride	32.68
Tetrachloroethene	107.60
Trichloroethene	327.77

Concentrations are the 95 percent upper confidence limit on the arithmetic average of measured concentrations in ground water wells SW3, SW4, SW109, BW2, BW105, and BW109.

Human exposure to groundwater is of concern with respect to its potential use by local residents as drinking water. Potential exposure points are private wells that may be installed on the Site or downgradient from the Site and off of the property, where ingestion of water would be the route of exposure. There are currently no human receptors for groundwater at the Site nor at the property boundary. There are four private domestic water wells within a one mile radius of the Site (Figure 4). The nearest well, the Sprouse well, is upgradient from the Site. The remaining three are at least one-half mile from the Site and are not directly downgradient. Municipal water supply lines serve much of the area, running along all major roads (refer to Figure 4).

Although there are no current human receptors, a future residential use of groundwater scenario was developed for this Site because the groundwater is classified as a current potable drinking water aquifer by the State of South Carolina.

Potential direct contact with site-related chemicals in surface soil is limited to local residents or unauthorized persons who could possibly enter the Site. Probable exposure routes are through incidental ingestion and dermal absorption. Particulate inhalation is an unlikely route of exposure due to the thick vegetative cover at the Site. Off-site exposure to site-related chemicals is unlikely due to the vegetative cover at the Site which restricts off-site transfer either by overland runoff or atmospheric transport of soil particles. Exposure due to vaporization of site-related chemicals is considered to be minimal due to low concentration of volatile contaminants in the soil and therefore was eliminated as a potential route for exposure.

Other potential pathways for human exposure to site-related chemicals in surface soil are through the food chain. One potential pathway of human exposure is the direct ingestion of blackberries growing at the Site. A second potential pathway of human exposure consists of hunters harvesting and, along with family members, consuming wildlife that have fed on the Site. Wildlife species that might be hunted and consumed include white-tail deer, rabbits and quail. These species could feed on vegetation that may contain site-related chemicals through ingestion or dermal contact. Potential receptors also are limited due to the sparsely populated rural nature of the area. Furthermore, much of the Site is covered by clean fill, thereby limiting potential uptake of site-related chemicals by vegetation. Consequently, these pathways are retained.

Summary of Exposure Pathways for Quantitative Evaluation

- exposure to site-related chemicals in groundwater via ingestion of drinking water; assuming a consumption rate of 2 liters per day, 365 days per year for 30 years.

- contact with site-related chemicals in near-surface Site soils through the ingestion and dermal absorption routes; assuming an ingestion rate of 0.2 grams per day (child) or 0.1 grams per day (adult), 365 days per year for 30 years.

Summary of Exposure Pathways for Qualitative Evaluation

- Exposure to site-related chemicals through the food chain

8.3 TOXICITY ASSESSMENT OF CONTAMINANTS

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of (milligrams per kilogram-day)$^{-1}$ {(mg/kg-day)$^{-1}$}, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainity factors have been applied. CPFs for the Site contaminants of concern are in Table 14.

Reference Dose (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainity factors have been applied (e.g., to account for the use of animal data effects on humans). These uncertainity factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. RfDs for the Site contaminants of concern are in Table 15.

8.4 RISK CHARACTERIZATION

The risk characterization step of the baseline risk assessment process integrates the toxicity and exposure assessments into quantitative and qualitative expressions of risk. The output of this process is a characterization of the site-related potential noncarcinogenic and carcinogenic health effects.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose.) By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The HI information for the Site contaminants of concern is summarized below:

TABLE 14

TOXICITY VALUES: CARCINOGENIC EFFECTS
CHEMICALS OF CONCERN
MEDLEY FARM SITE

5 9 0076

Chemical	Oral Slope Factor $(mg/kg/day)^{-1}$	Weight-of Evidence Classification	Source
1,1-Dichloroethene	6.0E-1	C	IRIS
1,1-Dichloroethane	(a)	C	IRIS
1,1,1-Trichloroethane	–	D	IRIS
1,1,2-Trichloroethane	5.7E-2	C	IRIS
1,1,2,2-Tetrachloroethane	2.0E-1	C	IRIS
1,2-Dichloroethane	9.1E-2	B2	IRIS
1,2-Dichloroethene (total)	(b)		IRIS
1,2-Dichloropropane	6.8E-2(a)	B2	HEAST
Acetone	–	D	IRIS
Benzene	2.9E-2	A	IRIS
2-Butanone	–	D	IRIS
Chloroform	6.1E-3	B2	IRIS
Chloromethane	1.3E-2	C	HEAST
Ethylbenzene	–	D	IRIS
Methylene Chloride	7.5E-3	B2	IRIS
Styrene	3.0E-2(a)	B2	HEAST
Tetrachloroethene	5.1E-2(a)	B2	HEAST
Trichloroethene	1.1E-2	B2	HEAST
Vinyl Chloride	2.3E+0	A	HEAST
1,2,4-Trichlorobenzene	–	D	IRIS
Butylbenzylphthalate	ND	C	IRIS
Di-n-butylphthalate	–	D	IRIS
Di-n-octylphthalate	(b)		IRIS
bis(2-Ethylhexyl)phthalate	1.4E-2	B2	IRIS

TABLE 14 (CONTINUED)

TOXICITY VALUES: CARCINOGENIC EFFECTS
CHEMICALS OF CONCERN
MEDLEY FARM SITE

5 9 0077

Chemical	Oral Slope Factor $(mg/kg/day)^{-1}$	Weight-of Evidence Classification	Source
Toxaphene	1.1E+0	B2	IRIS
PCBs	7.7E+0	B2	IRIS

(a) - Evaluation under review by EPA CRAVE Workgroup
(b) - Not evaluated by EPA
ND - Not determined
IRIS - Integrated Risk Information System (U.S. EPA, 1990c)
HEAST - Health Effects Assessment Summary Tables (U.S. EPA, 1990b)

TABLE 15

TOXICITY VALUES: NONCARCINOGENIC EFFECTS
CHEMICALS OF CONCERN
MEDLEY FARM SITE

Chemical	Chronic Oral RfD (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty and Modifying Factors	Source
1,1-Dichloroethene	9E-3	Medium	Liver effects	UF=1000 for H,A,L MF = 1	IRIS
1,1-Dichloroethane	1E-1			UFxMF = 1000	HEAST
1,1,1-Trichloroethane	9E-2	Low to Medium	Growth retardation	UF=1000 for H,A,S MF=1	IRIS
1,1,2-Trichloroethane	4E-3	Medium	Liver and immunologic effects	UF=1000 for A,S MF=1	IRIS
1,1,2,2-Tetrachloroethane	(a)				IRIS
1,2-Dichloroethane	(b)				IRIS
1,2-Dichloroethene	2E-2		Hematologic effects	UFxMF=100	HEAST
1,2-Dichloropropane	(b)				HEAST
Acetone	1E-1	Low	Liver and kidney effects	UF=1000 for A, S MF=1	IRIS
Benzene	(a)				IRIS
2-Butanone	5E-2	Medium	Fetotoxicity	UF=1000 for A, S MF=1	IRIS
Chloroform	1E-2	Medium	Liver and reproductive effects	UF=1000 for H,A,L MF=1	IRIS
Chloromethane	(b)				

TABLE 15 (CONTINUED)

TOXICITY VALUES: NONCARCINOGENIC EFFECTS
CHEMICALS OF CONCERN
MEDLEY FARM SITE

Chemical	Chronic Oral RfD (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty and Modifying Factors	Source
Ethylbenzene	1E-1	Low	Liver and kidney effects	UF=1000 for A, S MF=1	IRIS
Methylene Chloride	6E-2	Medium	Liver effects	UF=100 for A MF=1	IRIS
Styrene	2E-1	Medium	Hematologic and liver effects	UF=1000 for A,S	IRIS
Tetrachloroethene	1E-2	Medium	Hepatic effects	UF=1000 forA,S MF=1	IRIS
Trichloroethene	(a)				IRIS
Vinyl Chloride	(b)				IRIS
1,2,4-Trichlorobenzene	2E-2(c)		Liver effects	UF x MF=1000	HEAST
Butylbenzylphthalate	2E-1	Low	Liver effects	UF=1000 for A,S MF=1	IRIS
Di-n butylphthalate	1E-1	Low	Increased mortality	UF=1000 for H, A, S MF=1	IRIS
Di-n-octylphthalate	2E-2		Liver and kidney effects	UF x MF=1000	HEAST
bis(2Ethylhexyl) phthalate	2E-2	Medium	Liver effects	UF=1000 for H,A,S,L MF=1	IRIS

TABLE 15 (CONTINUED)

TOXICITY VALUES: NONCARCINOGENIC EFFECTS
CHEMICALS OF CONCERN
MEDLEY FARM SITE

Chemical	Chronic Oral RfD (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty and Modifying Factors	Source
Toxaphene	(b)				IRIS
PCBs	(b)				IRIS

(a) - Under review by EPA
(b) - Not evaluated by EPA
(c)-Withdrawn from IRIS pending further review
Uncertainty Adjustments: H = variation in human sensitivity
A = animal to human extrapolation
S = extrapolation from subchronic to chronic NOAEL
L = extrapolation from LOAEL to NOAEL
IRIS - Integrated Risk Information System (U.S. EPA, 1990c)
HEAST - Health Effects Assessment Summary Tables (U.S. EPA, 1990b)

Non-carcinogenic Effects Under Current Conditions

Exposure Pathway	Hazard Quotient
Soil Ingestion	2.6×10^{-5}
Dermal Absorption	2.6×10^{-4}
TOTAL EXPOSURE HAZARD INDEX	2.9×10^{-4}

Non-carcinogenic Effects Under A Future Residential Scenario

Exposure Pathway	Hazard Quotient
Ingestion of Groundwater	5.6
Soil Ingestion	1.4×10^{-3}
Dermal Absorption	4.0×10^{-3}
TOTAL EXPOSURE HAZARD INDEX	5.6

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-6). As excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. The excess cancer risk levels associated with the site contaminants and exposure pathways are summarized below.

The Agency considers individual excess cancer risk in the range of 10^{-4} to 10^{-6} as protective; however, the midpoint risk (10^{-6}) is generally used as the point of departure for setting cleanup goals at Superfund sites.

Carcinogenic Effects Under Current Conditions

Exposure Pathway	Risk
Soil Ingestion	7.7×10^{-8}
Dermal Absorption of Soil	7.8×10^{-7}
TOTAL EXPOSURE RISK	8.6×10^{-7}

Carcinogenic Effects Under A Future Residential Scenario

Exposure Pathway	Risk
Ingestion of Groundwater	1.1×10^{-2}
Soil Ingestion	4.2×10^{-6}
Dermal Absorption of Soil	1.1×10^{-5}
TOTAL EXPOSURE RISK	1.1×10^{-2}

There is no current risk associated with the ingestion of groundwater under baseline conditions since the groundwater plume containing site-related chemicals is presently located within the property boundary and no exposure points exist on the Site or at the property boundary.

The total estimated carcinogenic risk due to soil ingestion is 7.7×10^{-8}. For dermal absorption of chemicals in soil, the total carcinogenic health risk is 7.8×10^{-7}. These risks are mainly the result of the presence of PCBs in the soil. All of these risk levels are within or less than the EPA remediation goals of 10^{-4} to 10^{-6} risk levels. Therefore, the sum of current risks under current, baseline conditions, due to the contamination at the Site is 8.6×10^{-7} or a chance of 8.6 excess cancers in a population of 10,000,000 over a 70-year period.

If the hazard index exceeds unity there may be concern for potential adverse health effects. None of the hazard indices for the three exposure pathways exceeds unity. Adding the hazard indices for all the pathways to exposure to Site-related chemicals yields a total hazard index of 2.9×10^{-4} which is mainly the result of the presence of bis (2-ethylhexyl) phthalate. This sum is approximately four orders of magnitude below unity, thus there in no concern for potential non-carcinogenic health effects under present day Site conditions.

For the future on-site residential use scenario, estimated carcinogenic risk due to exposure to site-related chemicals is 1.1×10^{-2} for all pathways combined as can be seen below. Virtually all of the risk is from ingestion of groundwater containing 1,1-dichloroethylene. The risk level from direct contact with soil is 4.2×10^{-6} for soil ingestion and 1.2×10^{-5} for dermal absorption of chemicals in soil, both of which are within the remediation level goals of 10^{-4} to 10^{-6}. These risk levels are mainly the result of the presence of PCBs in the soils. The total non-carcinogenic hazard for future residential use of the Site is estimated to be 5.6 which exceeds unity. Ingestion of groundwater containing 1,1-dichloroethylene is responsible for virtually all of the non-carcinogenic hazard. Hazard indices for soil ingestion, 1.4×10^{-3}, and dermal contact with soil, 4.0×10^{-3}, are both less than one, indicating that there is no concern for potential health effects from direct contact with residual on-site soil contamination. Virtually all of the HI for soils results from the presence of bis (2-ethylhexyl) phthalate.

Although residual on-site soil contamination does not pose a direct threat to either human health or the environment, this residual on-site soil contamination does pose a indirect threat to human health as shown above by an estimated carcinogenic risk of 1.1×10^{-2} and non-carcinogenic hazard of 5.6. This indirect risk will persist until such time as the mass of contaminants in the unsaturated soil is reduced to a point where they will no longer adversely impact groundwater quality above MCLs.

Uncertainity:

The estimates of human health risks developed in the baseline risks assessment required a considerable number of assumptions about exposure and adverse human health effects.

8.5 ENVIRONMENTAL RISKS

Exposure to groundwater and soils containing site-related chemicals are potential sources of environmental endangerment. As stated previously, exposure to groundwater at the Site is not a present pathway of concern because the groundwater plume containing site-related chemicals is presently confined to the Site and no exposure points exist. The potential for endangerment of the flora and fauna of Jones Creek, the stream along the eastern end of the property, could exist if groundwater containing site-related chemicals entered this stream. However, no site-related chemicals were detected in the stream water samples, the sediment samples, or the monitoring wells closest to Jones Creek.

Because much of the Site has been covered with clean fill and is covered with vegetation, exposure of terrestrial animals to soil by dermal contact and ingestion is considered unlikely. Ingestion of plants potentially containing site-related chemicals is minimized because of the clean fill covering much of the Site. For species with large home ranges (e.g. deer), ingestion of plants growing on the Site will represent only a portion of their diets, thus further minimizing their intake of site-related chemicals. In summary, no potential for significant risk to wildlife population on or adjacent to the Site was identified. Furthermore, no endangered species or critical habitats are known to occur in the vicinity of the Site.

9.0 DESCRIPTION OF ALTERNATIVES

Tables 16 and 17 summarize the technologies considered for remediating/ controlling groundwater and source contamination, respectively at the Medley Farm site. These tables also provide the rationale as to why certain technologies were not retained for further consideration after the initial screening. Surface water/sediment remediation technologies were not evaluated as this environmental medium has not been impacted by the Site nor is it expected to be in the future. Although air is not a present exposure pathway, it may pose a risk during the implementation of either the groundwater treatment system or during the remediation of the soils. Any potential impact on air will be considered along with the description of each individual remedial alternative.

TABLE 16
GROUND WATER CONTROL
TECHNOLOGY SUMMARY

TECHNOLOGY	STATUS	REASON
GROUNDWATER RECOVERY		
EXTRACTION WELLS	RETAINED	
SUBSURFACE DRAINS/ INTERCEPTION TRENCHES	REJECTED	CANNOT BE INSTALLED AT DEPTH IN BEDROCK
ACLs	REJECTED	SITE CONDITIONS NOT APPROPRIATE
NO ACTION	RETAINED	
GROUNDWATER TREATMENT		
ACTIVATED CARBON ADSORPTION	RETAINED	
CHEMICAL OXIDATION	RETAINED	
BIOLOGICAL SYSTEM	REJECTED	CHLORINATED VOCS RESISTANT TO BIODEGRADATION
AIR STRIPPING	RETAINED	
LAND APPLICATION	REJECTED	RESISTANT COMPOUNDS, SEASONAL USE
GROUNDWATER DISCHARGE		
SURFACE WATER (JONES CREEK)	RETAINED	
GAFFNEY POTW	REJECTED	DISTANCE TO SERVICE
INFILTRATION GALLERY	RETAINED	PROVISIONALLY DEPENDING ON APPLICATION RATES
INJECTION WELL	RETAINED	PROVISIONALLY DEPENDING ON APPLICATION RATES

TABLE 17
SOURCE CONTROL
TECHNOLOGY SUMMARY

	TECHNOLOGY	STATUS	REASON
DIRECT TREATMENT	BIOREACTOR	REJECTED	EXCAVATION OF SITE TO REQUIRED
	LAND TREATMENT	REJECTED	DEPTH IS CONSIDERED INFEASIBLE
	SOIL WASHING	REJECTED	
	CEMENT-BASED STABILIZATION	REJECTED	
	SILICATE-BASED STABILIZATION	REJECTED	
	PROPRIETARY CHEMICAL FIXATION	REJECTED	
	LOW-TEMPERATURE DESORPTION	REJECTED	
	ROTARY KILNS	REJECTED	
	INFRARED THERMAL TREATMENT	REJECTED	
	FLUIDIZED BED INCINERATION	REJECTED	
IN-SITU TREATMENT	ENHANCED BIODEGREDATION	REJECTED	PERMEABILITY, DEPTH OF SOILS
	SOIL FLUSHING	REJECTED	FAILED EPA FIELD TEST, SOIL PERMEABILITY
	SOIL VAPOR EXTRACTION	RETAINED	
	VITRIFICATION	REJECTED	NOT SUFFICIENTLY DEMONSTRATED
OFF-SITE TMT/DISP	COMMERCIAL LANDFILLING	REJECTED	EXCAVATION OF SITE TO REQUIRED
	COMMERCIAL INCINERATION	REJECTED	DEPTH IS CONSIDERED INFEASIBLE
CONTAINMENT	CAPPING	RETAINED	
	SLURRY WALLS	REJECTED	FRACTURED BEDROCK PREVENTS EFFECTIVE USE
	GROUTING	REJECTED	CANNOT BE EFFECTIVELY APPLIED
	SHEET PILING	REJECTED	NOT APPLICABLE TO ROCKY SOILS, DEPTHS
	BOTTOM SEALING	REJECTED	NOT FULLY DEVELOPED
NO ACTION		RETAINED	

9.1 REMEDIAL ALTERNATIVES TO ADDRESS GROUNDWATER CONTAMINATION

Four sets of alternatives were developed to address groundwater contamination at the Site. The four groundwater control (GWC) remedial alternatives are:

GWC-1: No Action
GWC-2: Long-Term Monitoring and Institutional Control
GWC-3: Recovery and Treatment of Groundwater Across Entire Site
GWC-4: Recovery and Treatment of Groundwater at the Medley Farm Property Line.

Both Alternatives GWC-3 and GWC-4 have a subset of corresponding treatment approaches for the extracted groundwater. These alternatives and their associated treatments are described below.

9.1.1 GWC-1: No Action

The No Action alternative is included, as required by CERCLA and the NCP, to serve as a baseline for comparison with other groundwater control measures. This alternative would not involve any treatment or other remedial actions. The description of this alternative is included in the following section.

9.1.2 GWC-2: Long-Term Monitoring and Deed Restriction

This alternative is identical to GWC-1 but includes long-term monitoring of Site groundwater and the placement of a deed restriction to reduce the potential for the construction of potable wells on the property.

In Alternatives GWC-1 and GWC-2, Site conditions would remain unchanged. Slight remediation of contaminated groundwater may occur through natural processes such as bioremediation, adsorption, and dilution. Therefore, levels of groundwater contamination would remain above MCLs for a minimum of 20 years.

Implementation of Alternative GWC-1 could begin immediately and would have no negative impacts of future remedial actions. Operating costs would be incurred because of the mandatory review every five years. Implementation of Alternative GWC-2 may be delayed approximately one month as this approach may include the installation of additional monitoring wells. In addition, under GWC-2, a deed restriction would be placed on the property in an attempt to limit the future use of the groundwater. Capital costs for GWC-2 would be incurred for monitoring well construction; operating costs would include periodic groundwater sampling, chemical analysis, and reviewing and documenting Site conditions every five years; maintenance costs would be incurred for inspection of the monitoring wells.

Estimated Period of Operation: 30 years

Estimated Total Cost (net present worth):
Alternative GWC-1 $140,000
Alternative GWC-2 $790,000.

9.1.3 GWC-3: Recovery of Groundwater Across Entire Site

This alternative considers the entire Site as the point of compliance; therefore, under this alternative all groundwater exceeding MCLs at the Site will be recovered through a system of extraction wells. The Site is delineated by the extent of contamination in the groundwater.

The treatment system for the extracted groundwater would involve installing piping from each extraction well to a common treatment area, a specific treatment system, and discharging the treated groundwater. The estimated hydraulic flow for Option GWC-3 is 30 gallons per minute (gpm). Below are descriptions of three treatment options evaluated for treating the extracted groundwater for Option GWC-3. Figure 22 provides the tentative locations for the extraction wells, identified by circles with a dot in their middle, for this alternative.

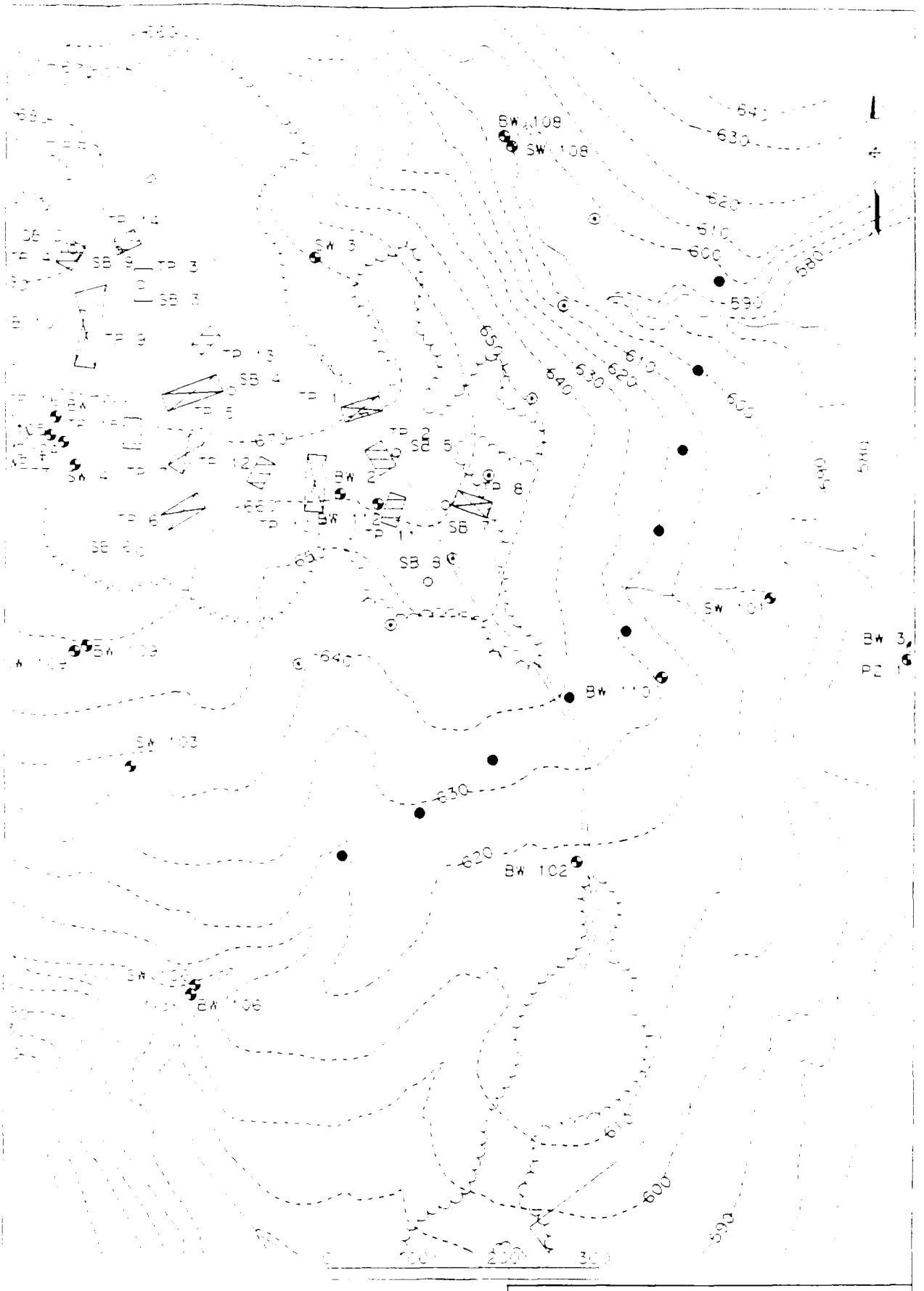
Of the four (4) discharge options retained after the initial screening discharging to Jones Creek via an NPDES discharge permit is the preferred discharge option (refer to Table 16). Discharging to the local publicly owned treatment works (POTW) was rejected due to the distance to the nearest hook up point. Both infiltration galleries and injection wells are technically feasible, but their usefulness is dependent on application rates of the discharge effluent. Therefore, all of the groundwater remediation alternatives discussed below will discharge treated groundwater is to Jones Creek via an NPDES permit.

9.1.3.1 GWC-3A: Recovery and Treatment of Groundwater Across Entire Site Using an Air Stripping Tower

Air stripping is a mass transfer process in which volatile compounds in a water column are transferred to an air stream within a packed tower. The air stripping tower will remove the volatile compounds to below quantation limits. The maximum air emission rate for VOCs would be approximately 44 pounds per month. South Carolina Air Pollution Control Regulation (No. 62.1, Section II, F.2g) states that VOC sources of less than 1,000 pounds per month may not require permits but that source information must be supplied to the Department. SCDHEC policy states that any source of air toxics must be reviewed for potential impact to receptors. To satisfy South Carolina requirements, calculated airborne concentrations at the stack were compared with allowable State ambient concentration levels Air Pollution Control Regulation (No. 62.5, Standard No. 8, Toxic Air Pollutants). The results of an air dispersion model conducted to estimate the airborne concentrations at the property line found that the contaminant levels would be below allowable State levels by a factor of more than 1,000. Maximum air stripper emissions from the Medley Farm site would therefore be protective of human health and would not require control.

Estimated Period of Operation: 30 years

Estimated Total Cost (net present worth): $1,900,000.



⊙ **Alternative GWC-3 Anticipated Arrangement of Extraction Wells**

● **Alternative GWC-4 Anticipated Arrangement of Extraction Wells**

FIGURE 22
POTENTIAL GROUNDWATER
RECOVERY SCHEMES
MEDLEY FARM SITE

9.1.3.2 GWC-3B: Recovery and Treatment of Groundwater Across Entire Site Using Activated Carbon

In the carbon adsorption system, the contaminated groundwater is forced through tanks containing activated carbon. Activated carbon is specially-treated material that naturally attracts the molecules of contaminating chemicals. As the groundwater moves through the filters, the contaminants cling to the carbon and the groundwater is cleansed as it leaves the system. The cost of replacing or reactivating the activated carbon so that it retains its effectiveness makes this option more costly to implement than GWC-3A.

Estimated Period of Operation: 30 years

Estimated Total Cost (net present worth): $2,500,000.

9.1.3.3 GWC-3C: Recovery and Treatment of Groundwater Across Entire Site Using Chemical Oxidation

Chemical oxidation is a process by which organic compounds, such as VOCs and SVOCs, are broken down into carbon dioxide and water. Oxidation can be achieved through a range of technologies.

Estimated Period of Operation: 30 years

Estimated Total Cost (net present worth): $2,500,000.

9.1.4 GWC-4: Recovery and Treatment of Groundwater at the Medley Farm Property Line

This alternative is designed to address groundwater contamination at the property line of the Medley Farm and not beneath the entire Site. Using the same range of treatment for extracted groundwater as described above in Section 9.1.3, this alternative focuses on removing groundwater from the perimeter of the property. The anticipated flow rate for this alternative is 15 gpm. The point of compliance for this alternative is the Medley Farm property line. Therefore, this alternative would insure that levels of contaminants in the groundwater would not exceed MCLs at the property line of the Medley Farm as presently owned by Mr. Ralph Medley. This alternative would allow contaminants to remain above MCLs in the groundwater beneath and just downgradient of the disposal area. The extraction wells represented by solid circles in Figure 22 correspond to Alternative GWC-4.

This alternative is protective under present day conditions as there are no receptors using the contaminated groundwater. However, this alternative would not be protective of future use of the aquifer in the event that a residence is built in the vicinity of the Site and the owner of such residence installs a potable well near or downgradient of the Site. The cost estimate for each of the treatment schemes discussed as part of Alternative GWC-4 are stated below:

5 9 0090

Estimated Period of Operation: 30 years

Estimated Total Cost (net present worth):
GWC-4A (Air Stripping) : $1,300,000
GWC-4B (Carbon Adsorption): $1,900,000
GWC-4C (Chemical Oxidation): $1,800,000.

9.2 REMEDIAL ALTERNATIVES TO ADDRESS SOURCE CONTROL

The following remedial action alternatives address contaminant source areas that are (1) currently accessible to the public, (2) may become accessible during the remedial action, or (3) act as a continuing source of contamination to groundwater at the Medley Farm site. These source areas must be remediated to the extent necessary to reduce the risks attendant to exposure to chemical residuals, or they must be isolated to prevent exposure. The four response actions to address source control (SC) at the Medley Farm Site are:

SC-1: No Action
SC-2: Institutional Controls
SC-3: Cap Source Areas
SC-4: Soil Vapor Extraction

Below are descriptions of each of the source control/remediation alternatives.

9.2.1 SC-1 No Action

In the No Action alternative, no further remedial action would occur. A slight reduction in the levels of the contaminants present may occur through natural processes; and short-term effectiveness presents no additional risks to the community or the environment. This alternative would not significantly reduce the toxicity, mobility, or volume of contaminants at the Site. Long-term effectiveness and permanence of this alternative would be reviewed every five years as required by Section 121(c) of CERCLA. Site soils would not change significantly over time and would likely continue to contribute chemicals to the groundwater above MCLs for up to 20 years.

The Baseline Risk Assessment under current conditions indicates that this alternative would be protective of human health and the environment. The current risk posed by Site under today's conditions is 8.6×10^{-7}. The Toxic Substances Control Act (TSCA) establishes remediation levels for PCBs in areas of unrestricted access, and the levels of PCBs encountered at the Site are below the action level of 10 ppm.

However, under the future use scenario, the Site would pose a significant risk. The risk, 1.1×10^{-2}, is mainly the result of using the contaminated aquifer beneath the Site for potable water. As in the risk assessment for current conditions, soils, under the future use scenario, do not pose a significant risk to human health.

The No Action alternative could be readily implemented, and would not hinder any future remedial actions. There are no construction costs associated with this alternative. However, operation and maintenance (O&M) costs would involve review of the remedy every five years.

Estimated Period of Operation: 30 years

Total Construction Costs:	$0
Estimated Present Worth O&M Costs:	$140,000
Estimated Total Costs (net present worth):	$140,000

9.2.2 SC-2: Institutional Controls

Alternative SC-2 is similar to Alternative SC-1 but includes the additional requirement of initiating institutional controls. Under this alternative, deed restrictions would be placed on the Medley property in an attempt to control future use of the property and prevent inadvertent exposure to chemical residuals.

Estimated Period of Operation: 30 years

Total Construction Costs:	$0
Estimated Present Worth O&M Costs:	$140,000
Estimated Total Costs (net present worth):	$140,000

9.2.3 SC-3: Cap Source Areas

This alternative involves construction and operation of a low permeability cap over Site soils. Capping is the covering of contaminated wastes or soils. In this approach, a layer of compacted soil would be used to cover the area; this layer would be covered with an impermeable synthetic liner to prevent wind, rain, and melting snow from carrying contaminants beyond their primary location. This approach would also prevent direct human and animal contact with contaminants. The finished cap would be covered with soil and seeded for erosion control and to make it blend into the landscape. Maintenance is minimal, requiring periodic inspections and the filling of cracks or depressions, if they appear.

Construction of a cap would involve heavy earth moving and grading equipment and the clearing of vegetation. Existing Site access would probably have to be improved. Dust control measures would be taken to minimize short term potential release of airborne particulates. In the implementation of this option, groundwater observation wells not required for long-term monitoring would be abandoned. Drainage swells and a security fence would be constructed along the cap perimeter. Deed restrictions would be included in the implementation of this alternative in an attempt to control future use of the Site.

There are no ARARs for capping at the Site, and Resource Conservation and Recovery Act (RCRA) disposal requirements are not applicable; however, the single synthetic liner cap design would meet an equivalent standard of performance to RCRA requirements.

Long-term effectiveness and permanence of this approach would rely on regular inspections to ensure the reliability of the cap; an inspection and maintenance schedule would be implemented following construction and continue as long as chemical residuals remained at the Site. Evaluation of cap effectiveness would be performed through periodic groundwater monitoring. If deemed necessary during the design phase, gas vents will be incorporated into the cap. Because residuals would remain at the Site, CERCLA Section 121(c) requires a review of effectiveness and protectiveness be made every five years.

Implementation of this alternative would not offer any reduction in toxicity or volume of chemicals at the Site. Use of an impermeable layer to limit the exposure of contaminants would help control migration if this alternative were employed in conjunction with one of the groundwater control options.

Operating cost would be incurred to maintain the cap and to develop reports and reviews of the Site remedy every five years. Biannual sampling would be conducted under this alternative.

Estimated Period of Operation: 30 years

Estimated Total Construction Costs:	$580,000
Estimated Present Worth O&M Costs:	$420,000
Estimated Total Cost (net present worth):	$1,000,000

9.2.4 SC-4: Soil Vapor Extraction

Source areas with chemical levels exceeding calculated levels that are protective of the groundwater would be remediated through soil vapor extraction (SVE). These calculated subsurface soil levels are based on a compound's potential to impact groundwater above promulgated standards. A leach model incorporating site-specific physical properties and environmental fate considerations were used. The factors used were: annual infiltration; chemical retardation; fate mechanisms volatilization, biodegradation, hydrolysis; soil type and properties; and groundwater flow.

Figure 23 identifies the areas of the Site where levels of residual soil contamination exceed the calculated concentrations that would be protective of the underlying aquifer. These concentrations are based on a leaching model which would protect the groundwater from being impacted above MCLs. The model takes the following parameters into consideration: infiltration, equilibrium, chemical partitioning, groundwater ARARs, and mixing of infiltration with groundwater. The calculated concentrations of volatile organics in the unsaturated subsurface soils that will be protective of Site groundwater to MCLs are presented in Table 18. This table also lists the locations where these soil remediation levels were exceeded.

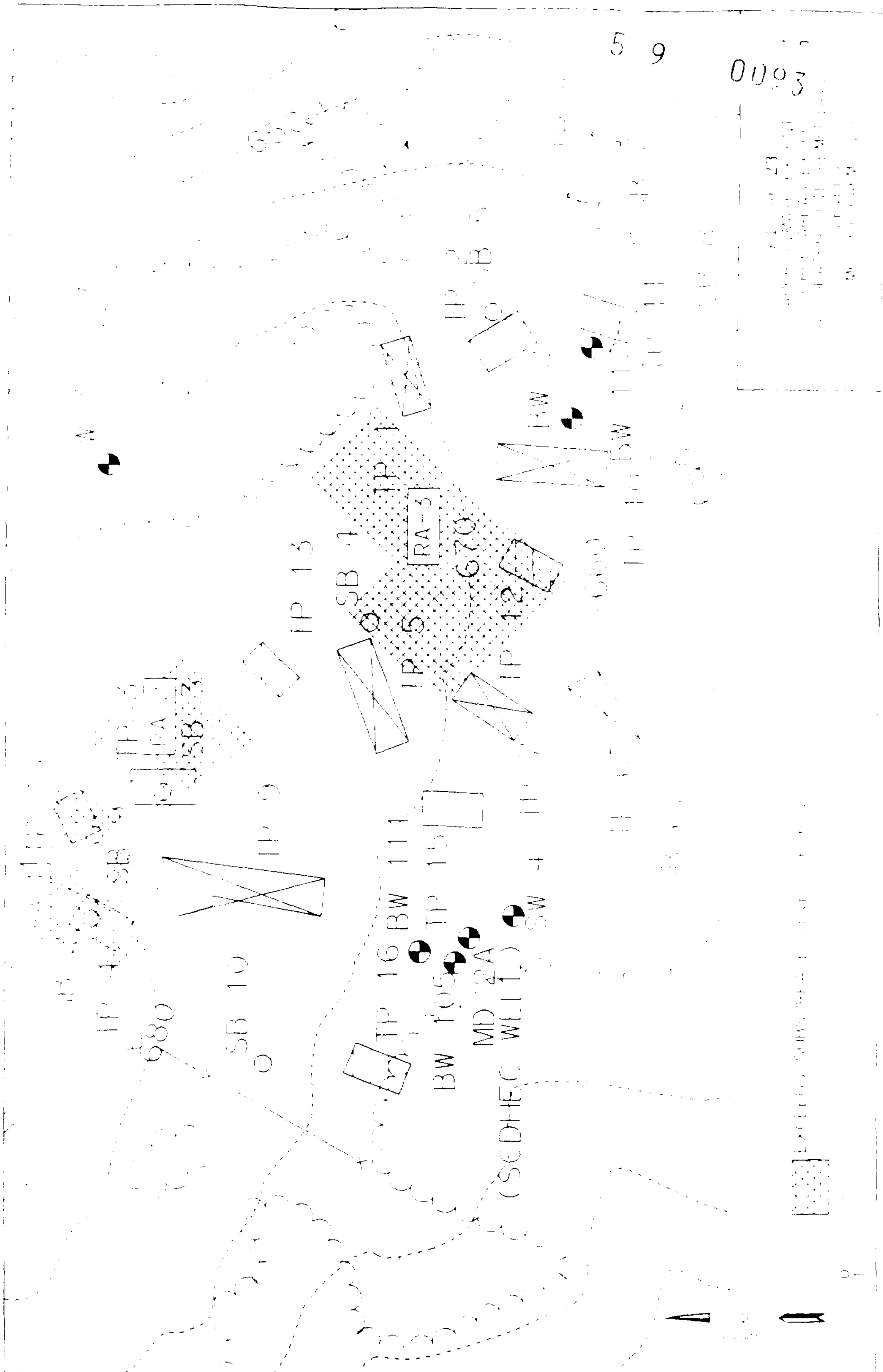

IP 13
SB 4
IP 1
RA-3
670
IP 5
IP 12
SB 3
IP 9
SB 10
980
TP 16
BW 111
TP 15
MD 2A
(SCDHEC WELL)

TABLE 18

POTENTIAL VOLATILE ORGANIC SOIL REMEDIATION LEVELS
MEDLEY FARM SITE

Compound	Soil Remediation Level (ug/kg)	Locations Where Remediation Level Exceeded
Acetone	12,000	(SB2)
1,1-Dichloroethane	100	None
1,2-Dichloroethane	60	TP12, SB4, (SB7), SB9
1,1-Dichloroethene	270	None
1,2-Dichloroethene (total)	2,100	TP3
1,1,1-Trichloroethane	26,000	None
1,1,2-Trichloroethane	160	None
Trichloroethene	500	TP3, TP4
Tetrachloroethene	1,600	TP3, TP4
Chloroform	3,000	None
Methylene chloride	40	TP4, (SB3)

NOTE: Locations given in parentheses are considered a minimal risk to ground water based on site-specific conditions.

SVE typically includes a series of slotted vertical injection vents connected by a common manifold to an extraction pump or blower. Volatile compounds and some SVOC's are withdrawn through an induced pressure gradient in the subsurface. Air emissions from the SVE system may require treatment, such as being scrubbed or sent through an activated carbon filter, prior to being vented to the atmosphere. The need for an emission control would be determined during the design. Upon completion of SVE activities, there would no longer be a significant source of chemicals to impact groundwater quality above the identified ARARs. The costs below anticipate that an air emission control system will be required.

Estimated Period of Operation: 1 year

Estimated Total Construction Costs:	$260,000
Estimated Present Worth O&M Costs:	$360,000
Estimated Total Cost (net present worth):	$620,000

9.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The environmental setting and the extent and characteristics of the contamination at the Medley Farm Site were defined in Section 7.0. Section 8.0 highlights the primary environmental media of and the human health and environmental risks posed by the Medley Farm site. Table 11 lists the contaminants of concern present in the groundwater and soils at the Site. This Section examines the cleanup criteria (ARARs) associated with the contaminants found on-site and the environmental media contaminated.

9.3.1 Action-Specific ARARs

Action-specific requirements set controls/restrictions on the design, performance, and other aspects for implementing a specific remedial activity. Since action-specific ARARs apply to discrete remedial activities, they are discussed in greater detail in Section 10.0. The three categories for action-specific ARARs are:

- ARARs for actions taken in all alternatives;
- ARARs for an action involving soil treatment; and
- ARARs for an action involving groundwater treatment.

The first category specifies requirements for safety and health, hazardous waste facilities, and transportation. The second category covers soil vapor extraction, capping, and related air emissions. The last category applies to the extraction and treatment of groundwater, the discharge of the treated groundwater, and related air emissions.

9.3.2 Chemical-Specific ARARs

Chemical-specific ARARs are concentration limits established by government agencies for a number of contaminants in the environment. Chemical-specific ARARs can also be derived in the Risk Assessment. Discussed below is each environmental medium investigated at the Medley Farm site as part of the RI and the associated chemcial-specific ARARs.

9.3.2.1 Groundwater

Groundwater at the Medley Farm site is designated as Class GB in accordance with the South Carolina water classification system and Class IIA under USEPA Groundwater Classification Guidelines (December 1986). The Class GB classification means that all groundwater meeting the definition of underground sources of drinking water meet quality standards set forth in the State Primary Drinking Water Regulation (R.61-58.5). EPA classifies the groundwater as Class IIA since the aquifer was and is being used as a source of drinking water. Therefore, the groundwater needs to be remediated to a level protective of public health and the environment as specified in Federal and State regulations governing the quality and use of drinking water.

The Safe Drinking Water Act and the State Primary Water Regulations establish MCLs and non-zero maximum contaminant level goals (MCLGs) for numerous organic and inorganic constituents. The Cleanup Criteria shown in Table 19 were established based on MCLs, proposed MCLs and MCLGs. Where MCLs were not available, risk based numbers were calculated as indicated by the appropriate table footnotes.

9.3.2.2 Surface Soils

The baseline risk assessment considered both present day conditions as well as a future risk scenario involving the construction of a residence on the Site at some time in the future. Under both scenarios, it was determined that the cumulative chemical concentrations of surficial soils at the Site do not pose a significant risk to human health; therefore, concentrations of individual chemicals would not present significant risks. Consequently, specific remediation levels for surficial soils were not developed.

The only contaminant detected in surface soil samples at the Site for which there is a promulgated Federal or State standard is PCBs. The promulgated standard of 10 milligrams/kilogram (mg/kg) for PCBs in areas of unrestricted access is specified in the TSCA (40 C.F.R. 761.125). Concentrations of PCBs detected in surface soil samples were all below 10 mg/kg. PCB levels at the Site are therefore in compliance with this ARAR.

Compound	Maximum Concentration (ug/L)	Well	Remediation Level (ug/L)	Source
Acetone	18	BW2	350	(1)
Benzene	11	BW105	5	MCL
2-Butanone	13	BW106	2000	(1)
Chloromethane	26	BW108	63	(2)
Chloroform	10	BW2	100	MCL
1,1-Dichloroethane	120	SW4	350	(3)
1,2-Dichloroethane	290	BW2	5	MCL
1,1-Dichloroethene	2200	SW4	7	MCL
1,2-Dichloroethene	31	SW4	cis: 70 trans: 100	MCL MCL
Methylene Chloride	110	BW2	5	pMCL
Tetrachloroethene	200	SW3	5	MCL
1,1,1-Trichloroethane	3400	SW4	200	MCL
1,1,2-Trichloroethane	18	BW4	5	pMCL
Trichloroethene	720	BW2	5	MCL

MCL Safe Drinking Water Act Maximum Contaminant Level (40 CFR Parts 141.61)

(1) Remediation level derived from EPA's Reference Dose (RfD).

(2) Remediation level represents a one in one hundred thousand excess cancer risk, chloromethane is a Class C carcinogen

(3) Remediation level derived from EPA's Reference Dose (RfD) with an additional 10-fold safety factor. 1,1-dichloroethane is a Class C carcinogen.

pMCL = Proposed Maximum Contaminant Level (55 FR 30370)

TABLE 19 POTENTIAL GROUND-WATER REMEDIATION LEVELS

9.3.2.3 Subsurface Soils

As specified in the Administrative Record, the levels of contaminants in the unsaturated subsurface soils will continue to adversely impact groundwater quality for an estimated 20 years. Therefore, the remediation levels for contaminants found in the unsaturated soils were calculated. These remediation levels would protect the groundwater from being impacted above MCLs. These calculations were based on a leaching model. The remediation goals for volatile organics in the unsaturated subsurface soils which would be protective of Site groundwater to MCLs are presented in Table 18.

9.3.2.4 Surface Waters

The RI determined that Jones Creek has not been impacted by any site-related chemicals. Therefore surface waters are not in violation of the Federal Ambient Water Quality Criteria (AWQC; EPA, 1986). This ARAR protects aquatic organisms.

Any discharge from a groundwater extraction and treatment system will be discharged to Jones Creek via a NPDES discharge permit.

9.3.2.5 Sediments

There are no promulgated Federal or State quality standards for sediments. No site-related chemicals were detected in sediment samples collected from Jones Creek during the RI. Accordingly, sediment quality criteria are not necessary.

9.3.3 Location-Specific ARARs

Location-specific ARARs consider Federal, State, and local requirements that reflect the physiognomical and environmental characteristics of the Site or the immediate area. Table 20 lists the location-specific ARARs that apply at the Medley Farm Site.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 21 lists the remedial alternatives that were considered in the detailed analysis of alternatives. This section summarizes the evaluation of these remedial alternatives as specified in the NCP.

10.1 THRESHOLD CRITERIA

An alternative must overall, be protective both of human health and the environment and comply with ARARs, unless waived, in order to be eligible for selection. If an alternative fails to protect human health or the

TABLE 20
POTENTIAL LOCATION - SPECIFIC ARARs
MEDLEY FARM SITE

SITE FEATURE/LOCATION	CITATION	REQUIREMENT SYNOPSIS	CONSIDERATION IN THIS FS
FEDERAL			
Within 61 meters (200 feet) of a fault displaced in Honocene time	40 CFR 264.18(a)	New treatment, storage, or disposal of hazardous waste prohibited; applies to RCRA hazardous waste; treatment, storage, or disposal.	Not an ARAR since Site is not within 200 feet of a fault displaced in Honocone time.
Within 100-year flood plain	40 CFR 264.18(b)	Facility must be designed, constructed, operated, and maintained to avoid washout; applies to RCRA hazardous waste; treatment, stored, or disposal.	Not an ARAR since Site is not in a 100 year flood plain.
Within flood plain	Protection of floodplains (40 CFR 6, Appendix A); Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302; Flood plains Executive Order (EO 11988)	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values; applies to action that will occur in a flood plain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood prone areas.	Not an ARAR since Site is not in a flood plain.
Within area where action may cause irreparable harm, loss or destruction of significant artifacts	National Historical Preservation Act (16 USC Section 469); 36 CFR Part 65	Requires that action be taken to recover and preserve artifacts when alteration of terrain threatens significant scientific, prehistorical, historical, or archaeological data.	Not an ARAR since Site is not a designated archaeological area.

TABLE 7.0 (CONTINUED)
POTENTIAL LOCATION - SPECIFIC ARARs

SITE FEATURE/LOCATION	CITATION	REQUIREMENT SYNOPSIS	CONSIDERATION IN THIS FS
Critical habitat upon which endangered species or threatened species depends	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR Part 200, 50 CFR Part 402; Fish and Wildlife Coordination Act (16 USC 661 et seq.); 33 CFR Parts 320-330	If endangered or threatened species are present, action must be taken to conserve endangered or threatened species, including consultation with the Department of Interior.	Not an ARAR since Site does not have endangered or threatened species
Wetlands	Clean Water Act Section 404; 40 CFR Part 230, 33 CFR Parts 320-330	For wetlands as defined by U.S. Army Corps of Engineers regulations, must take action to prohibit discharge of dredged or fill material into wetlands without permit.	Not an ARAR since Site is not in a wetlands are and no bodies of water or wetlands are to be modified.
	40 CFR Part 6, Appendix A	For action involving construction of facilities or management of property in wetlands (as defined by 40 CFR Part 6, Appendix A, section 4(j)), action must be taken to avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	Not an ARAR since Site is not in a wetlands area.
Wilderness area	Wilderness Act (16 USC 1131 et seq.), 50 CFR 35.1 et seq.	For Federally-owned area designated as wilderness area, the area must be administered in such manner as will leave it unimpared as wilderness and to preserve its wilderness.	Not an ARAR since Site is not in a wilderness area.
Within area affecting national wild, scenic, or recreational river	Wild and Scenic Rivers Act (16 USC 1271 et seq.), section 7 (a)); 40 CFR 6.302(e)	For activities that affect or may affect any of the rivers specified in section 1271(a), must avoid taking or assisting in action that will have direct adverse effect on scenic river.	Not an ARAR since Site is not on or near a scenic river.

TABLE 20 (CONTINUED)
POTENTIAL LOCATION - SPECIFIC ARARs

SITE FEATURE/LOCATION	CITATION	REQUIREMENT SYNOPSIS	CONSIDERATION IN THIS FS
Classification and potential use of an aquifer	• Guidelines for Ground Water Classification, EPA Ground Water Protection Strategy. (USEPA, 1984; USEPA, 1986)	Consider Federal and State aquifer classifications in the assessment of remedial response objectives.	TBC since drinking water wells have been installed and used in the vicinity of the Site. Note that this is not an ARAR but is USEPA policy and therefore falls into the category of other criteria or guidelines to be considered (TBC).
STATE			
Within 100-year flood plain	S.C. R.61.264.18 (b)	Facility located within a 100-year flood plain must be designed, constructed, and maintained to permit washout of any waste materials.	Not an ARAR since Site is not in a 100-year flood plain.
Wetlands	S.C. Pollution Control Act	Facility must not be located in a wetland.	Not an ARAR since Site is not in a wetlands area.

environment, or does not comply with ARARs, then this alternative cannot be selected. Below is a discussion of the screened alternatives in comparison with the threshold criteria.

GROUNDWATER CONTROL	DESCRIPTION
GWC-1	No action
GWC-2	Institutional Controls/Long-term monitoring
GWC-3	MCLs across the Site
GWC-4	MCLs at the property line

SOURCE CONTROL	DESCRIPTION
SC-1	No action
SC-2	Institutional Controls
SC-3	Cap source areas
SC-4	Soil vapor extraction of source areas

TABLE 21 RETAINED ALTERNATIVES FOR DETAILED ANALYSIS

10.1.1 Overall Protection of Human Health and the Environment

This criterion assesses the alternatives to determine whether they can adequately protect human health and the environment from unacceptable risks posed by the Site. This assessment considers both the short-term and long-term time frames.

Alternative GWC-1 would be protective of human health and the environment under present conditions as there are no current receptors. However, this alternative would not be protective of human health in the event that the Medley Farm property was developed into a residential area in the future. Under this scenario, it is assumed that any such residents would install potable wells. As can be seen in Tables 9 and 10, a number of contaminants in the groundwater are above MCLs.

Alternative GWC-2 is an extention of Alternative GWC-1 but this alternative involves the use of institutional controls, such as deed restrictions, in an attempt to reduce the potential for the installation of a potable well on the Site in the future. The remainder of the evaluation for Alternative GWC-2 under this criterion would be the same as for Alternative GWC-1.

Alternative GWC-3 would remediate all groundwater at the Site to MCLs which would be protective of human health in the future while Alternative GWC-4 was designed to achieve MCLs at the Medley Farm property line. Under present conditions, these alternatives would be protective since there are no receptors. However, under a future residential use scenario, GWC-4 would not be protective of human health and GWC-3 would be protective of human health.

As documented in the Baseline Risk Assessment, Site soils do not represent a significant risk to human health. Risks from soils to populations of either flora or fauna could not be quantified but are limited because most of the surface soil is clean fill which effectively reduces exposure via direct contact to the residual contaminants in the unsaturated, subsurface soils at the Site. Exposure of fauna populations is further reduced as animals do not feed exclusively at the Site. Source control alteratives SC-1, no action, and SC-2, institutional controls, would be protective of human health and the environment.

Alternative SC-3, placing a cap over the Site, would significantly reduce the leaching of residual contaminants from the unsaturated soils into groundwater via infiltration of precipitation. This Alternative would limit the future risks posed by soils to groundwater. The reduced leaching potential would translate into lower chemical loadings into groundwater, hence lower risks to potential downgradient receptors. The limited risk identified in the Risk Assessment as vegetative uptake of contaminants would be eliminated by Alternative SC-3 by removing existing vegetation and capping the major source areas.

Even though Site soils do not pose a significant risk to either human health or the environment, the FS did determine that residual VOCs will continue to impact groundwater above MCLs for a minimum of 10 years and potentially up to 20 years. Alternative SC-4 requires the installation and implementation of a soil vapor extraction (SVE) system. The SVE system would be operated until remaining levels of contaminants in the soils would no longer impact the groundwater above MCLs. Operation of the SVE system would satisfy South Carolina ambient air requirements. Therefore, this alternative would be protective of human health and the environment.

10.1.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

This criterion assesses the alternatives to determine whether they attain applicable or relevant and appropriate requirements (ARARs) under federal environmental laws and state environmental or facility siting laws, or provide justification for waiving an ARAR. Section 9.3 defines the three types of ARARs: Action-Specific, Chemcial-Specific, and Location-Specific. The Site specific ARARs are identified below.

10.1.2.1 Action-Specific ARARs

The off-site discharge of treated groundwater to Jones Creek via a NPDES permit must comply with the Clean Water Act (CWA), Section 402. As the discharge will be a point source, the following sections of CWA will also apply: 301, 304, 306, 307, 308, and 403. The NPDES program is implemented under 40 CFR 122-125.

The required treatment for extracted groundwater in Alternatives GWC-3 and GWC-4 is air stripping. ARARs for air stripping include: the Clean Air Act (CAA), Section 109, National Ambient Air Quality Standards (NAAQS) (40 CFR 50); Resource Conservation and Recovery Act (RCRA) (40 CFR 264.251(f), 40 CFR 264 & 265 Subparts Y, Z, AA, & BB); and South Carolina Air Pollution Control Regulations No. 62.1, Section II, F.2.g and No. 62.5, Standard No 8. Toxic Air Pollutants.

10.1.2.2 Chemical-Specific ARARs

Groundwater cleanup standards for this Site are set at the most stringent of the following ARARs or To-Be-Considered guidelines (TBCs) since the aquifer has been and is continuing to be used as a source of drinking water: the RCRA Maximum Concentration Limits (MCLs); the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), which include RCRA MCLs; the SDWA MCL Goals (MCLGs ; and federal and state Water Quality Criteria (WQC).

The second to the last column in Table 19 lists the cleanup goals for the contaminants identified as chemicals of concern in the groundwater at the Medley Farm site. The last column in this table provides the source for the specific cleanup goal. The point of compliance for obtaining these cleanup goals is the entire Site.

The cleanup goals calculated for contaminants found in the unsaturated subsurface soils, TBCs, can be found in Table 18. These levels were based on a leaching model conducted during the FS.

10.1.2.3 Location-Specific ARARs

Currently there are no location-specific ARARs applicable to the Site, including the Endangered Species Act as there are no endangered species currently within the area affected by the Site. Table 20 listed all the location-specific ARARs reviewed with respect to the Medley Farm site.

10.1.2.4 ARAR Evaluation

All of the alternatives evaluated will comply with its particular set of ARARs which are specified above. However, it is the time to achieve the groundwater cleanup standards which distinguishes one alternative from another as well as by the fact that Alternatives GWC-1, GWC-2, SC-1, and SC-2 rely on natural attentuation to meet ARARs, rather than active restoration.

As Alternative GWC-1 is a no action alternative, there are no action-specific ARARs to be considered and Alternative GWC-1 does not violate any location-specific ARARs. Alternative GWC-1 will not obtain MCLs in the groundwater in the near future as it was estimated that leaching of contaminants from the soil will continue to adversely impact groundwater above MCLs for approximately 20 years. After this time frame, an insufficient quantity of contaminants would remain in the unsaturated zone to leach into the groundwater to result in levels above MCLs.

Alternative GWC-2 extends the requirements of Alternative GWC-1. Alternative GWC-2 also requires periodical groundwater monitoring to verify that contaminant concentrations at the Medley Farm property line are below MCLs.

Under Alternative GWC-3, all identified ARARs would be satisfied: MCLs in groundwater, the effluent to Jones Creek via an NPDES permit, and air emissions from the air stripping tower.

Alternative GWC-4 would not achieve MCLs across the Site, only at the Medley Farm property line. Treated groundwater and the air emissions from the air stripper would meet ARARs as specified above for Alternative GWC-3.

The only identified ARAR for contaminants detected in Site soils is the TSCA remediation level of 10 mg/kg for PCBs in areas of unrestricted access. None of the PCB soil samples were above the 10 mg/kg level. As there are neither endangered species, nor areas of significant historical importance, Alternatives SC-1 and SC-2 would not violate any location-specific ARARs. And since Alternative SC-1 is a no action alternative, there are no action-specific ARARs for this alternative to be evaluated against.

All identified ARARs would be adhered to by Alternative SC-3. The single synthetic liner cap design would meet an equivalent standard of performance to RCRA requirements. All construction activities would take place above the 100-year flood plain. The Health and Safety Plan governing all remedial activities would protect on-site workers. The implementation of Alternative SC-3 would not pose an unacceptable risk to the community.

As with Alternative SC-3, Alternative SC-4 would adhere to ARARs. This alternative would remediate subsurface soils to below calculated remediation levels specified in Table 18. As stated earlier, operation of the SVE system would conform to South Carolina air emission requirements. Spent activated carbon from the in-line carbon adsorption system will be treated, regenerated or disposed of in an approved hazardous waste landfill. ARARs for RCRA, including land disposal restrictions (LDRs) for any spent carbon will be adhered to as part of Alternative SC-4. Potential location specific ARARs would be as described for Alternative SC-3.

10.2 PRIMARY BALANCING CRITERIA

These criteria are used to evaluate the overall effectiveness of a particular remedial alternative.

10.2.1 Long-term Effectiveness and Permanence

This criterion assesses the long-term effectiveness and permanence an alternative will afford as well as the degree of certainty to which the alternative will prove successful.

Under Alternatives GWC-1 and GWC-2, the risks posed by the residual contamination would remain unchanged. Since residual contamination would remain at the Site, review of the effectiveness of this alternative would be required every five (5) years. Conditions at the Site are not anticipated to change significantly over the first 5 year period. The additional activity to be included for Alternative GWC-2 is the periodic monitoring of the groundwater. Other than this, the activities remain the same as described for Alternative GWC-1.

Under Alternative GWC-3 and Alternative GWC-4, extraction wells would achieve removal of groundwater for subsequent treatment. Groundwater recovery via extraction wells and submersible pumps is a readily implementable technology with a certain degree of success. Air stripping is an effective and reliable process for removing VOCs from water. Maintenance consists of periodic inspection of the wells, pumps, control units, packing, blower, and transfer pumps. A 5-year review of this remedy would not be required once the remediation levels were maintained and verified for an extended period of time.

Potential migration pathways for chemicals in Site soils are surface run-off and leaching to groundwater. The RI determined that chemical migration via surface run-off was not significant; however, VOCs, the primary chemicals of concern, would leach from the unsaturated zone and impact groundwater above MCLs. Since waste residuals would be left in place under Alternatives SC-1, SC-2, and SC-3, review of the effectiveness and protectiveness of these alternatives would be required at least every five years. Conditions at the Site are not anticipated to change significantly during the first five year period.

Chemical transport following the construction of a cap under Alterative SC-3 would be significantly less than under current coniditions. Remaining risks associated with chemical residuals outside of the cap would not be significant. Evaluating the effectiveness of Alternative SC-3 could be accomplished through periodic groundwater monitoring. Since landfill residuals would remain at the Site, review of the effectiveness and protectiveness of this alternative every five years would be required. Inspection and maintenance records for the cap would be reviewed at this time. Conditions at the Site are anticipated to improve with the placement of the cap.

The SVE system as called for by Alternative SC-4 would be operated until the levels specified in Table 18 were attained. Confirmation sampling may be required to verify that the remediation levels had been achieved before the SVE system was shut down. Following the completion of Alternative SC-4, subsurface soils would no longer impact groundwater above remediation levels,

therefore, no long-term management of the Site would be required following implementation of this alternative. Even though soils would no longer adversely impact groundwater, a five year review would still be required because contaminant levels in the groundwater exceed ARARs.

10.2.2 Reduction of Toxicity, Mobility or Volume

This criterion assesses the degree to which the alternative employs recycling or treatment to reduce toxicity, mobility, or volume (TMV) of the contaminants present at the Site.

Neither Alternative GWC-1 nor Alternative GWC-2 would significantly reduce the toxicity, mobility or volume of Site residuals. A slight level of remediation may occur through natural processes, but site-related chemicals would remain in both Site soils and the groundwater and have the potential to discharge to Jones Creek under this alternative. However, such discharge would not pose a significant risk.

Under Alternative GWC-3 and Alternative GWC-4, groundwater extraction would reduce the volume of chemicals at the Site while the subsequent treatment would reduce the toxicity of groundwater prior to discharge. The Feasibility Study calculated that Alternative GWC-3 would reduce the total mass of VOCs in the groundwater by more than 99 percent and Alternative GWC-4 would achieve a 95 percent reduction.

Neither Alternative SC-1 nor Alternative SC-2 would significantly reduce the TMV of remaining Site residuals. Some remediation may occur through natural processes such as biodegradation, adsorption, dilution, and volatilization.

Alternative SC-3 would greatly reduce the mobility and potential exposure of chemicals above the water table. The mobility of chemicals below the water table would not change significantly. There would be no reduction in toxicity or volume of site-related chemicals.

Alternative SC-4 will permanently reduce the volume of VOCs in soils by more than 95 percent, thereby addressing the risk soil contamination poses to groundwater. Extracted VOC levels that exceed State ambient air limits would be adsorbed onto activated carbon. The spent activated carbon could be either incinerated or regenerated, depending on a cost comparison to be completed in the Remedial Design. Some reduction of SVOCs in the soils will also be achieved through the implementation of this alternative.

10.2.3 Short-term Effectiveness

This criterion assesses the short-term impact of an alternative to human health and the environment.

Neither Alternative GWC-1 nor Alternative GWC-2 present any risks to the community, on-site workers, or the environment due to implementation. The only difference between Alternative GWC-1 and Alternative GWC-2 is that Alternative GWC-1 would probably require the installation of additional monitoring wells.

The installation of extraction wells and the emissions from the air stripper called for by Alternative GWC-3 and Alternative GWC-4 would pose no significant threat to the community or on-site workers. During the actual construction of the remedial action, the on-site workers would be protected from potential risks through adherence to the remedial Health and Safety Plan. It is estimated to take approximately three (3) months to implement either of these alternatives.

Since neither Alternative SC-1 nor SC-2 require that any type of activity be implemented, these alternatives would not present additional risks to the community, on-site workers or the environment due to implementation. These alternatives can be implemented immediately.

In order to implement Alternative SC-3, grubbing and grading of the Site would be necessary for construction of the cap. Dust control would need to be exercised to minimize the potential release of air-borne particulates. Worker safety can be controlled through adherence to the Health and Safety Plan. It is estimated this alternative would take approximately three (3) months to implement.

Alternative SC-4 presents no risks to either the community or on-site workers during installation or operation. Emissions during operation would be controlled to insure the mass of contaminants being released into the air is below allowable ambient levels. Installation of the SVE system would require approximately one month and start-up could require another month. It is anticipated that SVE would reduce the residual contamination below soil remediation levels in one year.

10.2.4 Implementability

This criterion assesses the ease or difficulty of implementing the alternative in terms of technical and administrative feasibility and the availability of services and materials.

Alternative GWC-1 is a no action alternative, and thus can be implemented immediately. Alternative GWC-2 would require a short period of time to implement as it would only require the possible installation of additional monitoring wells and the initiation of institutional controls.

No problems are anticipated in implementing either Alternative GWC-3 or Alternative GWC-4. These alternatives may require the installation of extraction wells and additional monitoring wells, if needed. Distribution lines to the groundwater treatment system would be below grade and heat traced to prevent potential freezing where placed above the frost line. Installation of an air stripper for the anticipated flow of 30 gpm under

Alternative GWC-3 or the flow of 15 gpm under Alternative GWC-4, would have no special installation requirements and the groundwater treatment system should be readily constructed.

Alternatives SC-1 and SC-2 can be implemented immediately, and neither would hinder the implementation of any remedial actions in the future. No Site maintenance would be required. As there would be no change in the TMV of the soils, the Site would need to be reviewed every five years.

The construction of the cap as required by Alternative SC-3 is a straightforward operation. Clearing the Site and establishment of access for heavy machinery should pose no difficulties.

The installation of the SVE system as called for in Alternative SC-4 presents no difficulties. The SVE vacuum and control system is designed to run unattended. The only required utilities are electrical and telecommunication services. Control of air emissions would be coordinated with SCDHEC. Disposal of entrained water does not present any significant difficulties. SVE is a demonstrated technology using standard equipment that is offered by a number of vendors.

10.2.5 Cost

This criterion assesses the cost of an alternative in terms of capital costs, annual operation and maintenance (O&M) costs, and net present value of capital and O&M costs.

Alternative GWC-1 involves no capital costs. Operating costs consist of a review of the Site conditions every 5 years. There would be no maintenance costs. A summary of the estimated costs is given below:

Total Construction Costs -	$0
Present Worth O&M Costs -	$140,000
Total Present Worth Costs -	$140,000

Capital costs for Alternative GWC-2 include the construction of up to four additional monitor wells. Operating costs include periodic sampling selected monitoring wells, chemical analyses of these samples, and reporting on, and reviewing the Site conditions every 5 years. Maintenance costs would include inspection of the monitor wells. A summary of the estimated costs is given below:

Total Construction Costs -	$ 35,000
Present Worth O&M Costs -	$750,000
Total Present Worth Costs -	$785,000

As discussed in Section 9, Alternative GWC-3 originally had three different treatment options. They were:

GWC-3A - Air Stripping,
GWC-3B - Activated Carbon Adsorption, and
GWC-3C - Chemical Oxidation.

Since alternatives GWC-3A, -3B, and -3C achieve equivalent treatment of the contaminated groundwater, the air stripping technology is preferred over the two other alternatives due to a cost comparison, both 3B and 3C were eliminated based on a cost comparison.

Construction costs associated with Alternative GWC-3 include mobilization; extraction wells and the groundwater distribution system; the groundwater treatment system; discharge line to Jones Creek; upgrading the Site roads; and utility connections. Operating costs include power and maintenance for the extraction wells; labor, power, and sampling for the treatment system; and groundwater monitoring. Maintenance costs include facility inspections and equipment repair.

A summary of the estimated costs is given below:

Total Construction Costs -	$ 610,000
Present Worth O&M Costs -	$ 780,000
Total Present Worth Costs -	$1,390,000

Construction costs associated with Alternative GWC-4 include mobilization; extraction wells and the groundwater distribution system; the groundwater treatment system; discharge line to Jones Creek; upgrading the Site roads; and utility connections. Operating costs include power and maintenance for the extraction wells; labor, power, and sampling for the treatment system; and groundwater monitoring. Maintenance costs include facility inspections and equipment repair.

A summary of the estimated costs is given below:

Total Construction Costs -	$ 520,000
Present Worth O&M Costs -	$ 770,000
Total Present Worth Costs -	$1,290,000

There are no construction costs associated with either Alternative SC-1 or SC-2. Operating costs consist of a review of the Site conditions every 5 years. There would be no maintenance costs. A summary of the estimated costs for both SC-1 and SC-2 is given below:

Total Construction Costs -	$ 0
Present Worth O&M Costs -	$140,000
Total Present Worth Costs -	$140,000

Construction costs associated with Alternative SC-3 include mobilization, excavation, grubbing, grading, earth work, material, and labor. Operating costs include maintenance of the cap, reporting, and review of the Site every five years. Maintenance costs include periodic inspections and grounds keeping.

A summary of the estimated costs is given below:

Total Construction Costs -	$ 580,000
Present Worth O&M Costs -	$ 420,000
Total Present Worth Costs -	$1,000,000

Construction costs associated with Alternative SC-4 include installation and materials for the SVE wells and manifold piping. Operating costs include leasing of the SVE equipment, disposal of spent carbon, and regular monitoring and maintenance.

A summary of the estimated costs is given below:

Total Construction Costs -	$260,000
Present Worth O&M Costs -	$360,000
Total Present Worth Costs -	$620,000

10.3 MODIFYING CRITERIA

State and community acceptance are modifying criteria that shall be considered in selecting the remedial action.

10.3.1 State of South Carolina Acceptance

The State of South Carolina concurs with the selected remedy.

10.3.2 Community Acceptance

A Proposed Plan Fact Sheet was distributed to interested entities on February 8, 1991. Copies of the Proposed Plan were sent to local residents, local newspapers, local radio and TV stations, the PRP steering committee, and local, State, and Federal officials. The Proposed Plan public meeting was held on February 12, 1991.

The public comment period on the Proposed Plan was began on February 13, 1991 and was to close on March 14, 1991. However, due to a letter requesting an extension to the public comment period, the comment period did not end until April 12, 1991.

Only one set of written comments were received during the public comment period. These comments and the questions asked during the February 12 public meeting are summarized in the attached Responsiveness Summary.

11.0 DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for this Site is:

- extraction and on-site treatment by air stripping of groundwater contaminated across the entire Site;
- off-site discharge of treated groundwater to Jones Creek via an NPDES discharge permit;

- in-situ soil vapor extraction of contaminated soils (those above the calculated soil remediation levels);

- review the existing groundwater monitoring system to insure proper monitoring of groundwater; if deemed necessary, additional monitoring wells will be installed to mitigate any deficiencies in the existing groundwater monitoring system; and

- monitoring of soil, groundwater, and surface water.

This remedy will attain a 10^{-6} cancer risk level across the entire Site. To obtain this risk level, this remedial action alternative requires the extraction and treatment of groundwater above MCLs as well the removal of residual soil contamination that would continue to adversely impact groundwater above MCLs.

11.1 MONITORING EXISTING CONDITIONS

As part of the Remedial Design, the wells listed below, at a minimum, will be sampled and analyzed on a quarterly basis. Samples from the following wells will be analyzed for the same range of volatile organics as in the RI: SW-1, BW-1, BW-4, SW-101, SW-106, BW-106, SW-108, and BW-108. The following well samples will also be analyzed for the same range of semi-volatile organics as in the RI: SW-3, SW-4, BW-2, and BW-105. If the first set of analyses for semi-volatile organics verifies the findings of the RI, then the sampling and analyses for semi-volatile organics can be discontinued during the RD.

The two tributaries to Jones Creek that border the Site shall also be sampled during the RD. The sampling point in the tributary that lies to the northeast of the Site shall be in the vicinity, downgradient of monitoring well cluster SW-108/BW-108. The sampling point in the tributary that lies south of the Site shall be in the vicinity, downgradient of monitoring well cluster SW-106/BW-106. These samples, both surface water and sediment, shall be analyzed for volatile organics. This analytical data will confirm if contaminated groundwater is discharging to these tributaries. If contamination is found in either of these tributaries, then these sampling points will be added to the overall monitoring scheme for the Site to be developed in the RD.

11.2 GROUNDWATER EXTRACTION, TREATMENT, AND DISCHARGE

This remedial action will consist of a groundwater extraction and treatment system, and an overall monitoring program for the Site. Groundwater contaminated above MCLs will be extracted across the entire Site. This will be accomplished by installing a series of extraction wells located within and at the periphery of the contaminant plume in the saprolite and bedrock portions of the aquifer.

The estimated total volumetric flow is 43,200 gallons per day. This is based on a 30 gpm groundwater extraction system operating 24 hours a day. More precise groundwater withdrawal and discharge values will be developed as part of the remedial design. As stated previously, the point of compliance is the entire Site.

The extraction system will be developed in the remedial design. It is anticipated that 7 extraction wells will be needed (refer to Figure 22). Pump tests and groundwater modeling may be required for the design of the extraction system.

Treatment of groundwater will be accomplished by means of an air stripping tower. From the extraction wells, groundwater will be pumped into an equalization tank before it is fed to the air stripping system. The air stripper will remove the VOCs from the groundwater. If the treated groundwater meets standards to be specified in the NPDES discharge permit, it will be discharged to Jones Creek. Due to the potential of having concentrations of metals above allowable levels in the effluent under the NPDES program, it may be necessary to reduce metal concentrations in the groundwater prior to discharge. Metal removal from the groundwater may consist of precipitation, flocculation, ion exchange, or some other cost effective method.

The following details will need to be addressed as part of the remedial design: (1) the need to remove metals from the extracted groundwater prior to discharging to Jones Creek; (2) the disposal of any waste stream associated with the removal of metals; and (3) the need for controlling the off-gas of the air stripper. The necessity for removing metals prior to discharging the treated groundwater to Jones Creek will be addressed in the preparation for obtaining the NPDES discharge permit. Data generated as part of the RD will also confirm if the off-gas from the air stripper, laden with volatiles stripped from the groundwater, will need to be controlled.

As stated previously, the goal of this remedial action is to restore groundwater to its beneficial use as a drinking water source. Based on information obtained during the RI and on a careful analysis of all remedial alternatives, EPA and the State of South Carolina believe that the selected remedy will achieve this goal. Groundwater contamination may be especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve cleanup goals at all points throughout the area of the plume, cannot be determined until the extraction system has been implemented, modified as necessary, and plume response monitored over time. If the implemented groundwater extraction system cannot meet the specified remediation goals, at any or all of the monitoring points during implementation, the contingency measures and goals described below may replace the selected remedy and goals for these portions of the plume. Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of containment technologies and institutional controls. These measures are considered to be protective of human health and the environment and are technically practicable under the corresponding circumstances.

The selected remedy will include groundwater extraction for an estimated period of 30 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

a) alternating pumping at wells to eliminate stagnation points;

b) pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater;

c) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume; and

d) at individual wells where cleanup goals have been attained, and after analytical confirmation, pumping may be discontinued.

To ensure that cleanup goals will be obtained and maintained, the aquifer will be monitored at those wells where pumping has ceased initially every year following discontinuation of groundwater extraction. This monitoring will be incorporated into an overall Site monitoring program which will be fully delineated in the Operations and Maintenance portion of the Remedial Design.

If it is determined, on the basis of the preceding criteria and the system performance data, that certain portions of the aquifer cannot be restored to their beneficial use, all of the following measures involving long-term management may occur, for an indefinite period of time, as a modification of the existing system:

a) engineering controls such as physical barriers, or long-term gradient control provided by low level pumping, as containment measures;

b) chemcial-specific ARARs will be waived for the cleanup of those portions of the aquifer based on the technical impracticability of achieving further containment reduction;

c) institutional controls will be provided/maintained to restrict access to those portions of the aquifer which remain above health-based goals, since this aquifer is classified as a potential drinking water source;

d) continued monitoring of specified wells; and

e) periodic reevaluation of remedial technologies for groundwater restoration.

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at intervals of at least every five years, in accordance with CERCLA 121(c). To ensure State and public involvement in this decision at this Site, any changes from the

remediation goals identified in this ROD will be formalized in either an Explanation of Significant Difference document or an Amendment to this Record of Decision thereby, providing an opportunity for State and public participation.

11.3 SOURCE REMEDIATION

Although the Baseline Risk Assessment indicates that residual soil contamination under present day conditions does not pose an unacceptable risk to either human health or the environment, the soils will continue to adversely impact the quality of groundwater above MCLs at the Site. This leaching of contaminants from the unsaturated soils into groundwater results in an unacceptable indirect risk under the future risk scenario, consequently, SVE is warranted to remove contaminants from the soil.

A SVE system is an in-situ treatment process used to clean up soils that contain VOCs and SVOCs by inducing a vacuum in the subsurface soils. The SVE system consists of a network of air withdrawal (or vacuum) wells installed in the unsaturated zone. A pump and manifold system of PVC pipes is used for applying a vacuum on the air withdrawal wells which feed into an in-line water removal system and an in-line vapor phase carbon adsorption system for VOC and SVOC removal. The subsurface vacuum propagates laterally, causing in-situ volatilization of compounds that are adsorbed to soils. Vaporized compounds and subsurface air migrate to the air extraction wells, essentially air stripping the soils in-place.

At the Medley Farm site, the vacuum wells can be installed vertically to the full depth of the contaminated unsaturated zone (approximately 60 feet below surface level). Vertical wells were selected due to the depth of the soil strata requiring remediation, geotechnical conditions, and the depth to groundwater.

Once the well system is installed and the vacuum becomes fully established in the soil column, VOCs and some SVOCs are drawn out of the soil and through the vacuum wells. In all SVE operations, the daily removal rates decrease as contaminants are recovered from the soil. This treatment technology has been proven effective at treating soils that contain elevated levels of organic contaminants.

The application of SVE to the unsaturated zone remediation is a multi-step process. Specifically, full-scale vacuum extraction systems are designed with the aid of laboratory and pilot-scale VOC stripping tests. Further testing will be performed as part of the remedial design.

The final disposition of the spent activated carbon from the in-line carbon adsorption system will be specified in the remedial design. The three options to be considered are treatment, disposal at an approved hazardous waste landfill or regeneration of the carbon. Compliance with ARARs for RCRA, including LDRs for treatment, storage, and/or disposal of spent carbon will be assured as part of the RD.

11.4 COST

The total present worth cost for the selected alternative is $2,404,000. The break down of this cost is specified below.

The present worth cost for the groundwater extraction and air stripping alternative is approximately $1,855,000. This cost includes a capital cost of $609,000 for construction of the groundwater extraction system, the treatment unit, treated groundwater discharge system, and all associated piping. This cost also includes annual expenditures for operation and maintenance of the system of $1,246,000 for 30 years.

The present worth cost for the SVE system with vapor phase carbon adsorption is approximately $549,000. This cost includes a capital cost of $344,000 for construction of the SVE system, the vapor phase carbon adsorption system, and all associated piping. This cost also includes annual expenditures for operation and maintenance of the system of $205,000 for 2 years.

Capital Cost for Groundwater Extraction and Treatment System	$ 609,000.00
Operation & Maintenance Costs for 30 years	$1,246,000.00
Capital Cost for the Soil Vapor Extraction System	$ 334,000.00
Operation & Maintenance Costs for 2 years	$ 205,000.00
TOTAL PRESENT WORTH COST	$2,384,000.00

12.0 STATUTORY DETERMINATION

The selected remedy satisfies the requirements of Section 121 of CERCLA.

12.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy will permanently treat the groundwater and soil and removes or minimizes the potential risk associated with the wastes. Dermal, ingestion, and inhalation contact with Site contaminants would be eliminated, and risks posed by continued groundwater contamination would be reduced.

12.2 COMPLIANCE WITH ARARs

This alternative will be designed to meet all ARARs of Federal and more stringent State environmental laws. A complete discusssion of the ARARs which are to be attained is included in Sections 9.3 and 10.1.2. These sections also describe the TBC requirements.

12.3 COST-EFFECTIVENESS

The selected groundwater and source remediation technologies are more cost-effective than the other acceptable alternatives considered primarily because they provide greater benefit for the cost.

12.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this action. Of the alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility or volume achieved through treatment; short-term effectiveness, implementability, and cost; State and community acceptance; and the statutory preference for treatment as a principal element.

12.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The preference for treatment is satisfied by the use of a vacuum extraction system to remove contamination from soil at the Site and the use of air stripping to treat contaminated groundwater at the Site. The principal threats at the Site will be mitigated by use of these treatment technologies.

Capping was the only retained containment technology. Subsurface containment methods, such as slurry walls, would be ineffective because of the fractured bedrock and were not retained for further evaluation.

A summary of the source control technology screening is presented in Table 5.4.

TABLE 5.4
SOURCE CONTROL
TECHNOLOGY SUMMARY

	TECHNOLOGY	STATUS	REASON
DIRECT TREATMENT	BIOREACTOR	REJECTED	EXCAVATION OF SITE TO REQUIRED
	LAND TREATMENT	REJECTED	DEPTH IS CONSIDERED INFEASIBLE
	SOIL WASHING	REJECTED	
	CEMENT-BASED STABILIZATION	REJECTED	
	SILICATE-BASED STABILIZATION	REJECTED	
	PROPRIETARY CHEMICAL FIXATION	REJECTED	
	LOW-TEMPERATURE DESORPTION	REJECTED	
	ROTARY KILNS	REJECTED	
	INFRARED THERMAL TREATMENT	REJECTED	
	FLUIDIZED BED INCINERATION	REJECTED	
IN-SITU TREATMENT	ENHANCED BIODEGREDATION	REJECTED	PERMEABILITY, DEPTH OF SOILS
	SOIL FLUSHING	REJECTED	FAILED EPA FIELD TEST, SOIL PERMEABILITY
	SOIL VAPOR EXTRACTION	RETAINED	
	VITRIFICATION	REJECTED	NOT SUFFICIENTLY DEMONSTRATED
OFF-SITE TMT/DISP	COMMERCIAL LANDFILLING	REJECTED	EXCAVATION OF SITE TO REQUIRED
	COMMERCIAL INCINERATION	REJECTED	DEPTH IS CONSIDERED INFEASIBLE
CONTAINMENT	CAPPING	RETAINED	
	SLURRY WALLS	REJECTED	FRACTURED BEDROCK PREVENTS EFFECTIVE USE
	GROUTING	REJECTED	CANNOT BE EFFECTIVELY APPLIED
	SHEET PILING	REJECTED	NOT APPLICABLE TO ROCKY SOILS, DEPTHS
	BOTTOM SEALING	REJECTED	NOT FULLY DEVELOPED
NO ACTION		RETAINED	